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Data on the Life History of *Ambystoma tigrinum californiense* Gray

By Victor C. Twitty

SINCE relatively little information is available concerning the *Ambystoma* of California, it seems desirable to record certain data accumulated during the past few years, mostly incidental to the collection of embryos and adults for experimental purposes.

The first observations on the spawning migration of *A. tigrinum californiense* were made recently by Professor W. H. Rich. During the first heavy rain of the season, on January 1, 1940, he collected approximately 45 adults between 10 and 11 P.M. on the highway bordering Lake Lagunita near the Stanford golf course. Twenty-eight of these had been killed by passing cars. The living specimens were migrating in the direction of the lake-bed, although the latter had not yet begun to fill with the winter rains. Of the dead specimens, dissection revealed that 18 were males and 4 females, with the remaining 6 too mangled for identification of their sex. The living specimens included 7 males, 8 females, and 2 immature specimens. The males were readily distinguishable without recourse to dissection by their heavily swollen cloacae and more prominently developed tail fins. Three of the larger males measured 21, 22, and 23 cm., as compared with 17, 18, and 19 cm. for the same number of females.[1]

The following evening, which was cool and clear, the writer visited the same half-mile stretch of road and found no animals. It was raining heavily again the next evening, January 3, however, and three excursions between 7:30 and 10 P.M. netted 15 females and 8 males. In addition, 5 or 6 injured or killed animals were observed. Two nights later Mr. L. E. DeLanney, also during a heavy rain, collected 4 females and one male in one trip along the same portion of road. The declining percentage of males in the three successive collections may or may not be indicative of a differential in onset of migration between the two sexes, which appears to be so marked for *A. maculatum* of the eastern United States (Moment, 1938).

A striking behavior was exhibited by the animals shortly after they were placed in a large tank of water on return to the laboratory. In several instances the male was observed to pursue the female actively around the aquarium, his head beneath her tail and appearing to nose her cloacal region. On the following morning a number of spermatophores were found attached to the floor of the aquarium. Although spawning of the females did not ensue, this is possibly attributable to the crowded and unnatural conditions afforded by the aquarium.

Data on Spawning

Most of our data on spawning have been collected from a temporary rain pool, roughly an acre in extent and scarcely more than a foot in depth, which forms each year during the winter rains in an open field on the Alpine Road

[1] Ten of these specimens were preserved for the collections of the Stanford Natural History Museum, Nos. A4784–4793.

about 5 miles from Stanford University. Eggs are often laid in great abundance in this pool, attached to the stems of grass and other plants. As reported by Storer (1925: 65), they are generally deposited singly, although groups of 2 to 4 are not uncommon. In one unusual case about 15 were found attached to a plant stem in an elongated cluster suggestive of that typical for *A. tigrinum* of the eastern states. Following is a summary of our records from this pool. Unless otherwise specified, the visits were made during the daylight hours.

On January 13, 1936, several eggs in young cleavage stages were collected; they were probably deposited the previous evening. The pool was visited again about 10 P.M. on January 14, during a warm rain, and 9 females were found in the act of spawning. The females were observed to grasp the plant stems with their hind legs while the eggs were being deposited. Three days later, January 17, many eggs ranging in development from morulae to advanced neural plate stages were collected or observed.

The following year, 1937, many eggs ranging from 2-cell to gastrula stages were collected on January 12. About two weeks later, January 25, another collection yielded embryos varying in development from gastrula to "tail-bud" stages. Their development had presumably been retarded by the cold weather intervening since the date of last collection. Two weeks later, February 8, with the exception of a few young neurulae, the product of a more recent spawning, all the embryos observed were in the motile stage of development which precedes hatching. These presumably belonged to the group first observed on January 12.

The following winter the pond was first visited on December 13, 1937. Only a few eggs were found, in blastula and gastrula stages. They had probably been deposited during the last rain two or three nights previously. All embryos collected on the next trip eleven days later, December 24, were in tail-bud stages of development, and probably belonged to the same group noted on the preceding visit. There was in fact apparently no resumption of spawning until considerably later in the season. After two fruitless trips in January, a few blastulae were found on February 6, 1938.

On January 2, 1940, the day following Prof. Rich's observations on the migration of adult *Ambystoma,* the pond on Alpine Road had not yet begun to fill with water. At the next visit on January 13, however, it was well filled, and many embryos were taken. The great majority of these were in tail-bud stages, although several neurulae and a few gastrulae were found. The evidence thus indicates that heavy spawning occurred only a few days after the first onset of migration as recorded above, and almost immediately upon accumulation of water in the pool.

Hyla regilla also spawns abundantly in the pool on Alpine Road, the onset of breeding seeming to coincide closely with that of *A. t. californiense. Triturus torosus* has never been observed to inhabit the pool, although it spawns regularly in a permanent pond only a few hundred yards distant. Conversely, *A. t. californiense* has not been known to spawn in the latter pool. In fact, as indicated by Storer (1925), this species appears to prefer the shallow waters of temporary bodies of water for its breeding activities. The two other loca-

tions where eggs of *A. t. californiense* have been taken by us, namely the margins of Lagunita as this lake fills during early winter, and a small pond on the Portola Road about 2 miles distant from the one on Alpine Road, both conform to this description.

Storer (1925: 65) records finding *A. t. californiense* embryos in advanced stages of development on February 15, 1924, in eastern San Joaquin County, and gives additional data concerning larval stages collected from pools in that region. On May 12, 1937, a Stanford student presented the writer with several larvae measuring approximately 80 to 90 mm., taken that day from Lagunita. Although the gills were still unreduced, these specimens were probably approaching metamorphosis, judging from the size at which transformation may occur in larvae reared in the laboratory.

Development

It is of interest to compare the developmental stages of this species with those of *A. tigrinum tigrinum,* since such a comparison serves to establish well marked differences as well as the fundamental affinities between the two forms. The eggs and embryos are very similar in size, both measuring about 2.0 mm. in diameter in the gastrula stage. The embryonic and larval stages also conform closely to the same morphological type, including general proportions of the body and such special features as absence of the 'balancer.' The eggs and embryos of *A. t. californiense* are less heavily pigmented than those of *A. t. tigrinum,* a distinction which also applies to the larval stages, although the general pattern of chromatophore arrangement is similar in both.

At least two features have been observed, however, which sharply differentiate the larvae of *t. californiense* and *t. tigrinum.* One of these is the rate of growth. Although we shall not attempt to present absolute data on this point, repeated experience has shown that under identical laboratory conditions the rate of larval growth is much higher in *t. tigrinum.* This difference has, of course, no utility as a taxonomic criterion, but it nevertheless serves to substantiate the genetic distinction between these two forms. The second feature concerns the relative size of the larval eye, which is markedly greater in *t. tigrinum* than in *t. californiense.* Incidentally, the size of the eye in *t. californiense* is almost identical with that of *Siredon mexicanum,* for larvae of any given length. Attention was called in an earlier paper to the smaller eye-size in *mexicanum* as compared with *t. tigrinum* (Twitty and Elliott, 1934: fig. 21).

It may be recorded here that the writer has artificially hybridized *A. t. californiense* with *S. mexicanum.* Highly viable offspring, all of which metamorphosed, were obtained and reared to maturity. An equally viable backcross resulted when eggs of *S. mexicanum* were fertilized with sperm from one of the hybrid males.

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STANFORD UNIVERSITY, CALIFORNIA.

Evidence of Venom in *Hypsiglena ochrorhynchus*

By RAYMOND B. COWLES

SPECIMENS of *Hypsiglena ochrorhynchus*, the spotted night-snake, have been found to feed freely on *Xantusia vigilis*, the yucca night-lizard. Where this lizard is not available it may be presumed that *Hypsiglena* may also feed on other small scaled lizards such as *Uta stansburiana, U. graciosa* and *Coleonyx variegatus*, as well as the very small young of other species. The availability of a food supply for juvenile individuals of *Hypsiglena* presents a different problem, for the young of this species are so small that in areas where *Xantusia* are not present the juveniles must perforce subsist on invertebrates as the adult *Sonora occipitalis* are known to do.[1] It is probable that those occurring in the habitat of the yucca night-lizard may augment this arthropod diet by feeding on the minute newly born young of these lizards, which appear in large numbers during late August, September, and well into November. Most of our juvenile *Hypsiglena* have been captured during this period and the chronological juxtaposition of juveniles of these species would appear to be an advantage to the snakes.

Repeated feeding episodes have suggested that the quiescence of captured lizards has been due to something more than the normal habitual docility of lizards once they have been overpowered by a snake, namely the presence of a functional venom. On several occasions lizards which have been captured and held by only one limb or the tail have been liberated and kept under observation with a view to determining whether or not visible evidence of toxemia might appear. In many there was no apparent evidence of toxemia, but in a number of instances death took place within a very few minutes after being bitten. Such deaths were attributed to possible mechanical injury resulting from deep punctures caused by the enlarged posterior maxillary teeth.

The enlarged posterior maxillary teeth have no more than a slight sug-

[1] Scorpions have been found in several freshly collected individuals of this species and have been fed to them in captivity. Under the latter condition they have also captured and consumed relatively large centipedes. Other arthropods presumably supply the small snakes with most of their food, especially the wingless burrowing cockroach, which is so abundant in the sandy areas inhabited by this species.

gestion of a groove-like depression, which under some lighting conditions may not show at all. Sectioning of the teeth will be required to determine whether or not there is an actual venom conducting channel present in this species. Direct experimental technique for determination of the presence of venom has not been attempted.

While doubt as to the exact nature of the lethal agent may be entertained, a number of deaths have taken place under conditions which suggest the presence of an effective venom. Such instances have been noted with three species of lizards, *Uta stansburiana, Coleonyx variegatus* and *Xantusia vigilis,* in which bites were so inflicted on limb or tail as to preclude the possibility of fatal mechanical injury. When no apparent injury has followed similar bites by *Hypsiglena,* the necessary chewing motions in which the fangs are repeatedly imbedded in the tissue had probably not taken place before the lizards were liberated.

In the lizards in which there was evidence of a venom, death has supervened in from 45 to 48 minutes, and except in two *Coleonyx variegatus,* edema and slight discoloration have been evident. In the light colored geckos it is probable that the absence of discernible swelling and discoloration may have been due to the fact that the venom was injected into the deeper tissues of the tail rather than just below the skin as in the other species.

Although fairly general swelling and discoloration was noted in a large *Xantusia* which a small snake had bitten with fatal results, the most interesting of the symptoms is the apparent loss of acute pain perception and the retention of effective motor responses until within a few minutes of death. The animals appear to be almost insensitive to touch, pressure and slight pain of pricking, but will respond to burning heat and even more readily to the sensory responses involved in balance, for when the animal is placed supine the righting responses take place until just before death supervenes.

The similarity of the effects of a bite by *Hypsiglena ochrorhynchus* in the three species of lizards observed so far, renders a comparative discussion unnecessary. An account of a typical case is given here.

On October 8, 1938, at 2:15 P.M., a small (1.2 gm.) *Hypsiglena* succeeded in capturing an adult male *Xantusia vigilis* weighing 1.4 gm. The lizard was grasped just posterior to the axillary region, in such a position as to eliminate the possibility of all but the slightest degree of puncture by the posterior teeth. In view of the small size of the snake, and the lateral position of its head, it appears impossible that there could have been any penetration by the posterior fangs into the peritoneal cavity, although a lateral fold of skin was accessible to the posterior teeth.

Immediately upon capture, the usual violent struggle to escape from the captor ensued. After a few seconds chewing motions were commenced by the snake, which was in such a position that the dorsal side of its head was applied to the latero-ventral surface of the lizard. The motions appeared to be identical with those employed by the lyre snake, *Trimorphodon vandenburghi,*[2] while injecting its venom.

[2] Observations on the California lyre snake, *Trimorphodon vandenburghi* Klauber, with notes on the effectiveness of its venom. Cowles, R. B. and Bogert, C. M., COPEIA, 1935: 80–85.

At 2:30 P.M., fifteen minutes after the attack was initiated, the lizard's respiration appeared to be shallow and more rapid than before the chewing motions had been employed by the snake. No count having been made prior to the time of the chewing motions, it can only be stated that there was an apparent increase in respiration, although when this specimen was compared to a nearby free lizard which had been undisturbed, the difference between respiration rates was marked.

At 2:35, the snake commenced the usual procedure of shifting its grasp so as to pass its head toward the anterior end of the lizard. Taking advantage of the loosening grip, the lizard was liberated at an opportune moment in such fashion as to avoid exerting any undue tension on its body. At this time it was noted that the limb adjacent to the punctures was apparently paralyzed, and this apparent paralysis passed rapidly across to the opposite adjacent limb and spread posteriorly so that there was an involvement of all four limbs thirty minutes after capture and within twenty-five minutes of the onset of chewing motions.

The term "apparent paralysis" has been used advisedly, since an almost complete narcosis to mechanical stimuli was evidenced. While the limbs appeared to be completely paralyzed, it was noted that when the animal was placed on its back a righting response was induced, during which the activity of the limbs appeared to be only slightly impaired; the tail was also used in righting.

At 2:45 P.M., a drop of blood was withdrawn from the site of the bite and compared with normal blood from a healthy individual. While the erythrocytes may have been normal, they appeared to be slightly smaller and with what appeared to be crenulate margins; but there was no clearly defined destruction of the cell wall.

Starting soon after the chewing motion had commenced, a marked edema of the fore limb, neck, and thorax was noted; and after apparent death occurred, at 3:00 P.M., forty-five minutes from the moment of capture, dissection revealed a high degree of edema of the subcutaneous tissues with little accompanying discoloration. The skin had lost tonus and appeared soft and gelatinous as compared with that in other areas of the body.

The evidence for the possession of an effective venom by *Hypsiglena ochrorhynchus* is limited, but it is the writer's belief that there can be no question as to the presence of a highly toxic venom. Owing to the reluctance of this species to bite large animals, it is almost impossible to test the effects of venoms on either larger lizards or mammals. An attempt to induce this species to bite a large specimen of *Crotaphytus silus,* and attempts to inject the venom by forceful opening of the snake's mouth followed by pressure after the fangs had been inserted, proved fruitless.

It should be reiterated that the small size of the snakes and their natural reluctance to bite larger objects renders them innocuous and places them in the harmless category so far as human beings are concerned.

BIOLOGICAL LABORATORIES, UNIVERSITY OF CALIFORNIA AT LOS ANGELES, CALIFORNIA.

A New Genus of Mexican Snakes Related to *Rhadinaea*

By Hobart M. Smith [1]

ONE of the most interesting and surprising results of the recent intensive herpetological explorations of the valley of Cuautlapan, Veracruz, is the present diminutive species. It adds another to the already imposing list of reptilian species known from this small, rich area. For the privilege of describing it, I am indebted to Dr. E. H. Taylor, who secured the specimens and presented me with one. I wish to express appreciation also for the drawing and for advice he has offered.

The species appears to be related to both *Rhadinaea* and *Diadophis*. It resembles *Rhadinaea* in having a capitate hemipenis, long recurved teeth, similar characters of the nasal plate (naris pierced in anterior section, bordered below by a ridge), absence of pits on dorsal scales, and certain other features. It approaches *Diadophis* in color pattern, character of temporals, and tail proportion. It resembles both in having smooth scales in 17 rows, normal colubrid scales on head (except temporals), and a line through the supralabials.

From these two genera it differs in numerous characters. From *Rhadinaea* it differs in its smaller size, short tail, straight spines on hemipenis, temporals 1 + 1, in color pattern, and in the relatively slight enlargement of the posterior teeth. The absence of pits on the dorsal scales, capitate hemipenis, and nearly homogeneous teeth differentiate it from *Diadophis*.

Despite similarity in size, body form, tail proportion and shape of head of this species and various species of *Tantilla*, the teeth show no relationship whatever between them. *Tantilla* also lacks a loreal.

Rhadinella, gen. nov.

Diagnosis.—Hypapophyses absent in posterior part of vertebral column; scales in 17 rows throughout (or reduced to 16 posteriorly), smooth, without apical pits; anal divided; head shields typical colubrid; nostril pierced in anterior section of nasal, bordered below by a ridge; head short; size small (250 mm.); tail relatively short, about 20 percent of total length; maxilla slender, with a moderate number of pointed teeth (16 or 17), the two posterior slightly enlarged, not or slightly grooved, separated by a very short diastema (or none) from the anterior; hemipenis capitate, with straight spines, sulcus divided. Type.—*Rhadinella schistosa*, sp. nov.

Rhadinella ***schistosa,*** sp. nov.

Type.—E. H. Taylor-H. M. Smith 23580, adult male, collected at Cuautlapan, Veracruz, August, 1940, by E. H. Taylor.

Paratypes.—EHT-HMS 23571, 23577–9, 23581, and U. S. National Museum 109914, all topotypes, collected by E. H. Taylor.

Diagnosis.—Size small (250 mm.); head short; dark above, light (orange) below, the dorsal color sharply differentiated from ventral; a broken white line through upper labials; a nuchal collar, interrupted medially, curv-

[1] Walter Rathbone Bacon Travelling Scholar, Smithsonian Institution.

ing forward on sides of head to mid-temporal region; eight upper and lower labials; ventrals 146 to 156, caudals 31 to 42.

DESCRIPTION OF TYPE.—Head a little flattened, somewhat broader than neck; snout somewhat truncate; lores nearly vertical; rostral somewhat broader than high, portion visible from above about half maximum length of internasals; median suture between internasals about half the length of that between prefrontals; maximum length of internasals about two thirds that of prefrontals; total area of internasals somewhat more than one third total area of prefrontals; latter extending somewhat on sides of head, about to a level with upper border of nostril; frontal hexagonal, sides curving, anterior angle obtuse, posterior angle a little less than a right angle; length of frontal (2.2 mm.) a little greater than its distance from tip of snout or the length of interparietal suture (1.9 mm.), less than maximum length of parietal (3.1 mm.); width of frontal (1.6 mm.) about twice width of supraocular (0.8 mm.).

Nasal divided below, grooved but not divided above; nostril pierced in anterior section of nasal, about equidistant from upper and lower borders, bordered below by a distinct ridge; anterior section of nasal a half larger than posterior, not so high, rectangular; loreal large, more or less square; one large preocular; one small postocular (abnormal, the upper postocular fused with supraocular); temporals 1 + 1, the anterior more elongate than others and in contact with postocular and supraocular (normally with both postoculars); eight supralabials, all rather low, seventh perhaps largest, fourth and fifth entering orbit; eight lower labials, fifth largest, first in contact with its mate medially, four in contact with anterior chin-shields, two with posterior; anterior chin-shields somewhat longer and broader than posterior, which are in contact most of their length, but posteriorly enclose two scales.

Scales in 17 rows throughout (except immediately in front of anus, where the vertebral row is dropped), smooth, without apical pits; ventrals 147; anal divided; subcaudals 40; a few distinct supra-anal tubercles.

Maxilla slender,[2] with 16 or 17 teeth, the two posterior slightly longer than others, not offset, not or indistinctly grooved (a flange present on posterior edge), preceded by a small diastema or none; teeth slender, sharply pointed, sharply recurved (rather angular), not as elongate near tips as in *Rhadinaea*. Palatines short, with nine teeth; pterygoid expanded and flattened posteriorly, with a moderately broad, median flange; 20 pterygoid teeth, the posterior third of bone (a sharp edge) toothless. Dentary with 18 teeth, decreasing in size anteriorly and posteriorly.

Hemipenis, in situ, extending to ninth caudal; sulcus divided at seventh caudal; distal fourth calyculate, fringed, capitate; a median portion (equal to length of four caudals, third to sixth inclusive) with spines; latter smaller near sulcus, largest on antisulcus side and toward base; about 24 large and medium-sized spines; all spines straight, not hooked; extreme basal portion ridged, with a few tiny spines.

Total length 187 mm.; tail 35 mm.

COLOR.—Dorsal surface of head black, with numerous minute flecks of

[2] Description of dentition from Nos. 23571 and 23581.

light brown visible with a lens; an irregular, broken, narrow white line extending from lower edge of seventh labial anteriorly through the middle of the supralabials, interrupted at the sutures; a fine white edge on supralabial border; a semi-circular white nuchal collar (stippled lightly with black) about two or three scale lengths in width, bordering edge of parietals and curving forward on each side of head about to anterior edge of secondary temporal; nuchal collar nearly completely divided medially by a narrow dark line; dorsal surface of body, to extreme lateral edges of ventrals, black, but the center of each scale visibly lighter; these light centers less distinct and more brownish medially, more distinct and reddish laterally; ventral surfaces of body and tail orange, except gular region, which is white; the orange color is brightest on posterior part of body, and fades somewhat on tail; lower labials and anterior chin-shields mostly black.

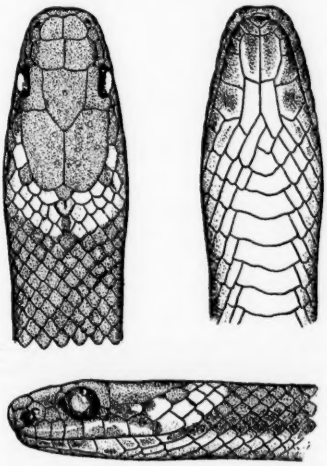

Fig. 1. Cephalic scutellation of the type of *Rhadinella schistosa*. x4.5.

VARIATION.—The greatest variation in scutellation of the head occurs in the postoculars. In one paratype (No. 23578) the upper postocular is fused with the supraocular, and in still another (No. 23581) the scales are fused on one side. In the others there are two separate postoculars. All have eight upper and lower labials, the first labial in contact with its mate, and temporals 1 + 1. In four specimens one scale row is dropped just in front of anus, reducing the count to 16.

The coloration is very uniform. The light centers of the scales are less distinct in some, frequently visible only on scales of the first or first and second rows. The belly is not so vividly orange in the young. In all the nuchal collar is broken medially by a narrow black line.

The largest specimen (No. 23571, female with eggs) measures 250 mm. in total length, the tail 37.5 mm. The ventrals and caudals of the type and paratypes are as follows:

	Number	Sex	Ventrals	Caudals
USNM	109914	♀	153	34
EHT-HMS	23579	♀	156	34
EHT-HMS	23571	♀	155	31
EHT-HMS	23578	♀	154	32
EHT-HMS	23580	♂	147	40
EHT-HMS	23581	♂	147	—
EHT-HMS	23577	♂	146	42

REMARKS.—This species bears an amazing resemblance to a species of *Tantilla* (similar to *schistosa*) common at the same place, with which it is found under stones. This resemblance is carried to body form, size, length of tail, orange ventral color, dark dorsal color sharply differentiated from ventral color, light centers of scales, dark markings on lower labials, and nuchal collar.

U. S. NATIONAL MUSEUM, WASHINGTON, D. C.

Amphibians of Eastern Ontario

By G. C. TONER and NANNETTE DE ST. REMY

THE amphibian fauna of the southeastern part of Ontario has received little attention. Latchford (1887), Small (1893), Odell (1900), Harrington (1903) and Patch (1918) published short articles on the salamanders and frogs of the Ottawa region. Klugh (1922) investigated the food of *Rana pipiens* at Kingston, Ontario, and Toner and Edwards (1938) reported on the amphibians of a lake in Leeds County. A recent paper by Trapido and Clausen (1938) contains a number of amphibian records from the vicinity of Ottawa. The topography and climate of the region have been discussed by Putnam and Chapman (1938).

The present paper is based in part on the collections of the Royal Ontario Museum of Zoology, in part on the authors' collections, and on some records from the National Museum of Canada. The senior author has been engaged in a study of the fish fauna of the region since 1933, and incidental to this work collections of amphibians were made and field notes recorded. The junior author took most of the Frontenac specimens while collecting material for a study of the "red leg" disease in frogs.

The authors wish to extend their thanks to Mr. E. B. S. Logier, of the Royal Ontario Museum, for permission to examine the collections at that institution and for verifying identifications; to Mr. C. L. Patch, of the National Museum of Canada, for permission to publish records; and to Mr. J. R. Dymond, Director of the Royal Ontario Museum of Zoology, for financial assistance towards the necessary field trips.

The localities in the following list have been assembled by counties.

LIST OF SPECIES

Necturus maculosus maculosus (Rafinesque).—CARLETON: Ottawa, in the Rideau and the Ottawa (Small, 1893; Patch, 1918). FRONTENAC:

Kingston, in Lake Ontario; Seeley's Bay in the Rideau Canal. GLENGARRY: Martinstown, in the Raisin. LEEDS: Brockville, in a small creek; Gananoque, in the St. Lawrence. STORMONT: Cornwall in the St. Lawrence.

The mud puppy occurs throughout the region in suitable localities. It is sometimes taken by anglers and mentioned in the local press as the "fish with legs." There is a record from Ottawa by Harrington (1903) which states that this salamander was common in the Ottawa River and at that time occasionally appeared in the city water mains.

Triturus viridescens viridescens (Rafinesque).—CARLETON: Ottawa (Patch, 1918). FRONTENAC: Adults from a small creek near Leland. LEEDS: Sub-adults from Gananoque; Eden Grove; Marble Rock.

The red sub-adults of the newt are often found under logs and stones while the green adults are taken from slow, muddy streams and shallow ponds. C. L. Patch has specimens from Frontenac County.

Ambystoma jeffersonianum (Green).—CARLETON: Ottawa (Patch, 1918). FRONTENAC: Kingston; Portsmouth; Washburn; Brewers Mills; Joyceville. LEEDS: Gananoque; Halstead's Bay; Ivy Lea; Bateau Point; Brockville.

Jefferson's salamander is common throughout eastern Ontario.

Ambystoma maculatum (Shaw).—CARLETON: Ottawa (Patch, 1918). FRONTENAC: Kingston; Brewers Mills; Collins Bay. LEEDS: Sand Bay; Brockville; Gananoque; Pittsferry.

The spotted salamander seems to be largely confined to woodlands. It breeds in spring ponds that have a heavy covering of leaves. Toner and Edwards (1938) mentioned the association of *Rana sylvatica* and spotted salamanders during the breeding season, both forms using similar situations for egg deposition. On April 21, 1933, these salamanders were noted spawning at Sand Bay, and on May 13, 1936, egg masses from which young were hatching were taken at Gananoque.

Plethodon cinereus (Green).—CARLETON: Ottawa (Patch, 1918). FRONTENAC: Brewers Mills. LEEDS: Gananoque.

The red-backed salamander is uncommon in our collections. The Royal Ontario Museum of Zoology has specimens from outside our limits on the west, north, and east, so it is probable that with further collecting it will be found throughout the region. C. L. Patch collected specimens in Frontenac County.

Eurycea bislineata bislineata (Green).—CARLETON: Ottawa. DUNDAS: Morrisburg.

The two-lined salamander has not been taken by us. The Royal Ontario Museum has a number of specimens that we were privileged to examine. Trapido and Clausen (1938) have recently erected a new sub-species, *E. b. major,* to which they referred the Ottawa specimens in the National Museum of Canada. We have examined 9 specimens from Ottawa. They appeared to have slightly longer tails and were somewhat larger in size, but otherwise agreed with typical *bislineata.* Three specimens from Hull, Quebec, could not be distinguished from those taken at Ottawa. One specimen from Montreal, Quebec, and one from Morrisburg, Dundas County, were without any characters that would have placed them in the new sub-species. Until more ma-

terial is available we think it advisable to refer all eastern Ontario specimens to *E. b. bislineata.*

Bufo americanus americanus Holbrook.—CARLETON: Ottawa (Patch, 1918). FRONTENAC: Kingston; Washburn; Parham. LEEDS: Gananoque; Athens.

The common toad of eastern Ontario is undoubtedly of this sub-species. Our earliest spring record is March 30, 1938, at Gananoque. Since 1935 these toads have started to sing each year between April 17 and April 21 in south Leeds. M. W. Curtis, at Athens, states that toads start singing about April 27, on the average about two weeks after the leopard frogs.

Pseudacris nigrita triseriata (Wied).—CARLETON: Ottawa (Patch, 1918). FRONTENAC: Eagle Lake; Kingston. GLENGARRY: Monkland. LEEDS: Gananoque.

Swamp tree frogs are probably more abundant than the records would indicate. We have usually found them associated with wood frogs in wet woods, never very far from water.

Hyla versicolor versicolor LeConte.—CARLETON: Ottawa (Patch, 1918). ADDINGTON: Napanee. FRONTENAC: Washburn; Kingston; Sunbury. LEEDS: Gananoque; Hay Island.

The tree toad is found throughout the region but is seldom taken except during its breeding season.

Hyla crucifer Wied.—CARLETON: Ottawa. FRONTENAC: Kingston; Collins Bay; Washburn. LEEDS: Gananoque; Black Rapids.

The spring peeper is a common species throughout eastern Ontario, but we have few specimens. In May they can be heard calling from every temporary pool or permanent pond. On one or two occasions we have heard the call in late October.

Rana catesbeiana Shaw.—CARLETON: Manotick; Ottawa (Patch, 1918). FRONTENAC: Eagle Lake; Parham; Dog Lake; Washburn. GLENGARRY: Alexandria; Glen Andrew; Lake St. Francis; Sutherland Creek. LEEDS: Gananoque Lake; Gananoque River; Charleston Lake; Newboro Lake; Singleton Lake, Wiltsie Creek, Crosby Lake. PRESCOTT: Winchester Creek. STORMONT: Doherty Creek; St. Lawrence River. RENFREW: Petawawa.

The bullfrog is found everywhere in the region in the larger lakes and streams. It is important commercially, many thousands of pounds being taken each year, during the open season, for the Montreal and New York markets.

Rana clamitans Latreille.—CARLETON: Ottawa. FRONTENAC: Eagle Lake; Parham. GLENGARRY: Laggan; Fraser's Point; Monkland; Bainsville; Apple Hill. LEEDS: Gananoque; Black Rapids. STORMONT: Doherty Creek.

The green frog is an aquatic species, inhabiting the large rivers and lakes as well as the smaller streams and ponds.

Rana palustris Le Conte.—CARLETON: Ottawa (Patch, 1918). FRONTENAC: Loughborough Lake; Washburn; Collins Bay; Parham; Pollywog Lake; Kingston. GLENGARRY: Upper Garry River; Alexandria. LEEDS: Caintown; Gananoque Lake; New Dublin; Jones Creek.

The pickerel frog is usually restricted to flowing streams, either cool or

warm. Specimens have been taken in trout brooks, at 55° F., and in drainage creeks, at 80° F. In Glengarry County in late September we found specimens a considerable distance from any water.

Rana pipiens Schreber.—CARLETON: Harwood Plains; Constance Lake; Fallowfield. DUNDAS: Froatsburg; Morrisburg. FRONTENAC: Kingston; Verona; Washburn. GLENGARRY: Bainsville; Laggan; Fraser's Point; Loch Garry; Alexandria; Apple Hill; Lancaster. GRENVILLE: Merrickville; Fairfield; Bishop Mills; Maitland. LANARK: Brassil's Creek. LEEDS: Blue Mountain; Brockville; Athens; Junetown; Gananoque; Gananoque Lake; Charleston Lake. PRESCOTT: Vankleek Hill. RUSSELL: Metcalfe. STORMONT: Doherty Creek.

The leopard frog is abundant in this part of the Province. Near Gananoque, on an island in the St. Lawrence, over 300 frogs were collected from an acre of ground over a period of three weeks in late June and early July, 1938. "Red leg" disease was quite prevalent in these wild frogs.

Rana septentrionalis Baird.—ADDINGTON: Buckshot Lake. CARLETON: Ottawa (Patch, 1918).

The mink frog is very uncommon if found at all, in the lower parts of this region. It has been taken above the 600 foot contour that crosses Frontenac County, the corner of Leeds and curves north through Lanark. Dr. E. Boyd of Queen's University used mink frogs from Westport, Leeds, in certain experiments.

Rana sylvatica sylvatica LeConte.—FRONTENAC: Eagle Lake; Parham; Collins Bay; Washburn; Kingston. GLENGARRY: Bainsville; Brodie, Monkland. GRENVILLE: Fairfield. LEEDS: Gananoque; South Lake, Gananoque Lake; Sand Bay; Junetown; Crosby Lake.

The wood frog is common throughout the region, spawning in woodland pools and apparently restricted to forested areas.

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KINGSTON, ONTARIO, CANADA.

Notes on the Life History of *Ambystoma gracile* Baird

By Gertrude M. Smith Watney

THE life history of this species in the region of Vancouver, British Columbia, has been studied by the writer intermittently over a period of years. The egg masses and larval forms are frequently observed in Beaver Lake, a small lake located at sea level in Stanley Park in the City of Vancouver, and aquatic forms have also been taken in lakes up to an altitude of 4000 feet on mountains in this vicinity. The present discussion deals largely with the life history as observed in Beaver Lake.

The egg masses, which have been well described by Slater (1936), are large and firm and have the stalk of an aquatic plant, a twig, or a bit of reed through the center. In some the egg capsules are provided, particularly at the later stages of development, with a growth of green algae resembling that described by Storer (1925) in the capsules of *Dicamptodon ensatus*.

Masses of eggs have been observed in this locality in March, April and May in different years. The earliest record which I have is of masses observed in Beaver Lake on March 2, 1940. These appeared to be newly laid. In other masses collected on March 4, 1925, the eggs were in the first cleavage stage and must have been only a few hours old. In some of these latter masses, which were removed to the laboratory, development progressed in a normal way and the first young larvae escaped from the capsules on April 7, approximately one month from the time of laying. In another mass collected in a small lily pond [1] on the campus of the University of British Columbia on May 13, 1932, the young were on the point of hatching and came out during the next two days. In a third lot of the eggs collected in Beaver Lake on April 23, 1939, the embryos were well formed and the first larvae escaped on May 11.

At the time of hatching the larvae measure from 14 to 15 mm. in length, the general body color is brown with yellowish marking, and the gills and fore limbs are slender. The caudal fin is well developed, the dorsal portion extending forward as a dorsal fin to the base of the head. At first the larvae spend the greater part of the time lying on the bottom of the aquarium tank or of the pond, but they can swim about actively if disturbed. They are evidently carnivorous from the first, for they will bite at small pieces of earthworm when only a few days old.

The larvae stay in the water until the second spring, at which time some of them metamorphose into terrestrial adult forms. Larval specimens varying in length from 50 to 80 mm. have been taken from Beaver Lake in February, March, April and May. One specimen, approximately 80 mm. in length, brought to me on October 27, 1930, was kept in the laboratory throughout the winter, and completed metamorphosis on April 20, 1931. At this time it measured 90 mm. This animal was one of several larvae hatched from eggs collected in the spring of 1930. Another specimen, approximately 71 mm.

[1] The *Ambystoma* in this pond were brought in at an earlier date in sludge from Beaver Lake.

in length, collected from Beaver Lake on February 23, 1931, had also completed metamorphosis by April 20 of that year; it measured only 75 mm. at the time of metamorphosis. By comparison with the former specimen it seems reasonable to conclude that this one was also from eggs laid in the spring of 1930. Of 2 larvae, approximately 75 and 80 mm. in length, brought in from Beaver Lake on May 23, 1939, one had completed metamorphosis on July 7. It measured 92 mm. at that time. The other, which measured 78 mm. on the latter date, still had well developed gills. It did not complete metamorphosis, since both specimens were preserved on July 11, 1939.

The animal brought in on October 27 exhibited an interesting change in feeding reactions at the time of metamorphosis. Like most others of the species, the larva was a voracious feeder, coming for food at any time and showing little preference in the kind of food. After metamorphosis, however, it refused to take the food offered to it and generally swam away. The desire to eat returned to some extent after a time and the animal was kept alive until August 10, 1931, when it died as a result of the extreme heat on a trip from California. At the time of death it measured 92 mm.

At the time of metamorphosis there is a distinct change in the color and marking. The color of the larvae in life is brown or olive green mottled with yellow and black. In some there are distinct yellow spots along the sides of the trunk and tail. The ventral surface is cream or very pale gray. The general effect is one of "brownness." On metamorphosis, the color changes to a dark, slate gray or black above, and to steel gray on the ventrum. All indication of marking or mottling is lost, the color thus becoming a uniform dark gray or black. Only rarely is there any indication of brown, and this, as a rule, only in preserved material.

As has been stated, some of the larvae metamorphose into terrestrial adults in their second spring. Others, however, remain in the water as paedogenic forms. How long they remain in this state or whether they ever metamorphose into terrestrial adults is as yet undetermined. Dr. Ian McTaggart Cowan reports having kept one animal for four years with no apparent external changes, such as degeneration of the gills or reduction of the caudal fin. The writer kept another specimen in the laboratory for two and one-half years with the same result. Unfortunately this animal died while I was away, and the record is incomplete. This specimen, which measured 170 mm. approximately, was taken on May 21, 1932, from the lily pond on the campus of the University and was one of several noted in this pond on May 13, when the egg masses previously referred to were collected.

On the latter date a gravid female, 125 mm. long, was also taken from the same pond. Although she did not lay after removal to the laboratory, and although no animal was observed in the act of laying, it is reasonable to assume that the egg masses were deposited by these animals. The pond is small and any other amphibians present could easily have been seen.

Similar large gilled forms, measuring approximately 120 mm. in length, were taken from Beaver Lake on March 24, 1931, and again in October of the same year. They have also been observed at other times in this lake. As indicated earlier, they have also been reported from the lakes on the local

mountains on several occasions. One specimen, measuring 140 mm., was taken from Hollyburn Mountain, at an altitude of 2500 feet, in June, 1930. Another, measuring 130 mm., was taken from Black Mountain, at an altitude of 4000 feet, on November 11, 1929.

In life the paedogenic forms are, like the larvae, brown or olive green in color with black markings and pale ventrum. In preservative the color fades to a cream or buff background with brown markings and cream or white on the under parts.

What causes some individuals of this species to remain as paedogenic forms while others metamorphose in their second spring is as yet unknown. Nor do we know what proportion of the larvae remain in this state. Since both conditions apparently may occur in the same locality and at the same level, as for example in Beaver Lake, distribution or altitude alone cannot be the determining factor. The phenomenon would appear to be due, to some extent at least, to the physiological "makeup" of the individual; hence the problem is one which may possibly be solved by experimental and physiological methods.

The terrestrial adults are not seen as frequently as are the aquatic forms. My collection at the present time includes seven female specimens and one male varying in length from 75 to 184 mm.

Of 4 individuals collected on March 16, 1939, a female 180 mm. in length had the ovaries and oviducts much increased in size, whereas the other three still had the gonads and ducts in a relatively immature condition. These 4 specimens were brought in, along with several *Triturus,* from a new road through Stanley Park about one-fourth mile from the margin of Beaver Lake. Although I have since visited this road many times and on it observed large numbers of *Triturus,* many of which were killed by motor traffic, I have seen no more *Ambystoma gracile.*

In life the terrestrial adults are beautifully sleek, dark gray or black in color with a slate gray ventrum. The eyes are dark and prominent and the parotoid glands are conspicuous. They are timid animals. In the laboratory they spend the greater part of the time beneath rocks in the water. They will usually come for food as soon as it is offered, but if they are disturbed or frightened they dart immediately for cover or swim frantically about the aquarium. It is no doubt this timidity which is responsible, at least in part, for the difficulty in finding these animals, even in pools at the breeding season when large numbers of egg masses indicate their presence.

In summary, it may be stated that the egg masses of *Ambystoma gracile* are laid in this region in March, April and May; that development of the eggs takes approximately one month; and that some of the larvae stay in the water through the first winter, metamorphosing into terrestrial adults in their second spring when they are 75–90 mm. in length, while others remain in the water as paedogenic forms for an unknown length of time.

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DEPARTMENT OF ZOOLOGY, UNIVERSITY OF BRITISH COLUMBIA, VANCOUVER, CANADA.

The Species of *Cirripectes* Swainson and a New Genus of Blennioid Fishes from the Tropical Pacific [1]

By LEONARD P. SCHULTZ

DURING recent studies on the fishes of the Phoenix and Samoan Islands, I have examined several species referred to the genus *Cirripectes* and wish to point out the distinctness of *C. leopardus* (Day) and *C. brevis* (Kner) as well as establish a new genus for *Cirripectes caninus* Herre, along with other observations on the various species referred to *Cirripectes*.

Gloriella, new genus

This new genus is characterized by four large somewhat curved or hooked canines near symphysis of both upper and lower jaws, with a row of smaller teeth around the jaws within the canines, the latter not interrupting the row of smaller teeth; the gill opening is nearly vertical and does not extend below the base of the pectoral fin; the width of the two is about equal; the lateral line ends above the first anal ray; a fringe of 25 or 26 nuchal cirrus occurs across the nape; caudal penduncle free; the anterior nostril has a broad fringe of tentacles; no orbital tentacle nor any tentacles on chin or lips; middle rays of caudal fin longest; other characters those of the type of the genus.

GENOTYPE.—*Cirripectes caninus* Herre.

[1] Published with the permission of the Secretary of the Smithsonian Institution.

This new genus differs from all other blennioid genera in having the fringe of tentacles across nape, four canine teeth at symphyses of jaws, a restricted gill opening, incomplete lateral line and naked body.

Gloriella named in honor of my small daughter, Gloria Ann, now three years of age.

Gloriella canina (Herre)

Cirripectes caninus Herre, Philip. Jour. Sci., 59, (2), 1936: 284, (type locality Ternate Is., Moluccas); Philip. Jour. Sci., 70 (4), 1939: 342.

Cirripectes Swainson

Cirripectes Swainson, Nat. Hist. Fishes, Amphibians, Reptiles, etc., 2, 1839: 275; haplotype *Salarias variolosus* Cuvier and Valenciennes.

Exallias Jordan and Evermann, Bull. U. S. Fish. Comm., 23, 1905: 503; type *Salarias brevis* Kner.

CHARACTERISTICS OF GENUS.—A transverse nuchal row of filaments; gill membranes free from isthmus and forming a broad fold across it; no canine teeth at front of jaws; teeth in a single row on jaws attached to the bone and not easily depressible; a notch between dorsals more or less separating the spinous and soft portions; body naked; lateral line more or less complete, with an arch over the pectoral fin; canines present or absent inside of mouth at corners of mouth; other characters those of the type of the genus.

Certain species, mentioned below, are doubtfully referred to the genus *Cirripectes*. *Blennius brevipinnis* Günther, Cat. Fishes Brit. Mus., 3, 1861: 226 (type locality Sandwich Islands; west coast of Central America); Günther, Jour. Mus. Godeffroy, 13, pt. 6, 1872: 194 (based on Hawaiian types). Nothing in the descriptions by Günther indicates that this species belongs to the genus *Cirripectes*. The description is too inadequate to properly identify the species.

Fowler, in *Fishes of Oceania* (1928), refers Seale's identification of specimens as *Salarias nitidus* Günther from Guam to the synonomy of *Cirripectes variolosus*. But Seale gives the dorsal rays as 32, anal 21; and no specimen of *Cirripectes* as yet has been reported with as many rays. Seale's description fits Günther's *S. nitidus* fairly well but the status of these specimens must await their re-examination.

The following key and table present the salient features for various species of *Cirripectes*:

1a. Body and pectoral fins everywhere covered with black spots on a paler background.

2a. Dorsal rays XII, 12; anal 16; about 30 to 34 tentacles in fringe across nape; the black blotches on body are arranged in groups of 4 to 6 spots that in turn more or less form 5 or 6 double bars; black spots on dorsals, caudal, and pectoral fins; anal fin blackish; nasal tentacles short multifid; on each eye the cirrus has a constricted base, expanding distally and with the outer edges broken up into numerous cirri; lower lip much convoluted; at each side of chin occurs a pair of barbels adjoining a pair of pores; canines absent; first two anal rays on the male here described are swollen and much convoluted; standard length 83 mm., from Oahu Island, caught by Otto Degener. . . . ***Cirripectes leopardus*** (Day)

2b. Dorsal rays XII (rarely XIII), 14; anal 17; about 50 to 60 tentacles in the fringe across nape (the inner row of tentacles at occiput not included in this

count); black spots everywhere on body and fins but not arranged in groups; vertical fins often lack the black spots and are plain blackish; nasal tentacles short, multifid; on each eye the numerous cirri arise from a broad double base; lower lip convoluted; barbels and pores at side of chin undeveloped; canines present; first two anal rays on male swollen and convoluted; description based on five females and one male, standard length 73 to 90 mm. . . . . *Cirripectes brevis* (Kner)

1b. Body and fins plain blackish or brownish, sometimes with obscure pale or darker spots but never uniformly black-spotted; pectoral fin plain without black spots; sometimes the young have several bars on a pale background of color.

3a. The number of cirri in ½ of the nuchal fringe of tentacles (on one side of nape) numbers from 15 to 20 or on both sides from 28 to 43; dorsal rays XII (rarely XIII), 14 or 15; anal 17 to 19 (usually 17 or 18); tentacles over eye from 2 to 5 (rarely 1 or 5), these arise from a common base; no pale spots observed in posterior half of body; first dorsal spine of males longer than the second [described as *C. filamentosus* (Alleyne and Macleay)], first dorsal spine of female as long as second, seldom shorter; anterior distal ⅓ to ⅔ of spiny dorsal white, abruptly darker basally; body and fins plain brownish to blackish (purplish in life), often paler anteriorly, and often with paler blotches on head (blue in life) especially on lower sides and throat; body sometimes with about 13 transverse bars; lower half of caudal fin darker than the upper half, sometimes dorsally it is nearly white distally. . . . . *Cirripectes variolosus* (Cuvier and Valenciennes)

3b. Number of cirri in ½ of nuchal fringe 10; dorsal rays XII, 15; anal 16; nasal tentacles pentafid; tentacle on eye trifid; lateral line incomplete posteriorly; "Entire body and head nearly uniform dark sepia, becoming dull yellowish along base of anal and caudal; dorsals pale pinkish and yellowish, rays red; caudal mostly pale orange, central part pale green, two quadrate reddish brown spots at base; anal dull greenish, basal part posteriorly yellow; ventrals dark brown; pectorals pale greenish above, pale orange below;" plate 1. (After Smith.) . . . . . *Cirripectes indrambaryae* Smith

COUNTS RECORDED FOR VARIOUS SPECIES OF *Cirripectes*[2]

	Soft Dorsal Rays	Anal Rays	Number of Cirri in Fringe on one Side of Nape
C. leopardus	12 (1)	16 (1)	18 (1)
C. brevis	14 (6)	17 (6)	27 (1)
			28 (3)
			29 (2)
C. variolosus	14 (14)	17 (13)	15 (5)
	15 (4)	18 (4)	16 (6)
		19 (1)	17 (3)
			18 (1)
			19 (2)
			20 (3)
C. indrambaryae	15 (1)	17 (1)	10 (1)

Cirripectes leopardus (Day)

Blennius leopardus Day, Fishes of India, pt. 2, 1876: 325, pl. 68, fig. 6 (type locality Hawaiian Islands).

Since Fowler (Fishes of Oceania, B. P. Bishop Museum, Mem., 10, 1928: 432), and other authors have either referred *Cirripectes leopardus* (Day) to the synonomy of *C. brevis* (Kner), or have identified specimens of it as *C. brevis*, it was thought necessary to point out the differences between these two species.

[2] Number in parentheses indicates number of specimens.

Cirripectes brevis (Kner)

Salarias brevis Kner, Sitz. Akad. Wiss. Natur., 58, 1868: 42, pl. 6, fig. 18 (type locality Savaii, Samoa).

Cirripectes variolosus Cuvier and Valenciennes

Salarias variolosus Cuvier and Valenciennes, Hist. Nat. Poiss., 11, 1836; 317 (type locality Guam).

Salarias sebae Cuvier and Valenciennes, Hist. Nat. Poiss., 11, 1836: 323 (type locality East Indies). The elongate first ray indicates it is a male of *C. variolosus*.

Salarias nigripes Seale, Occ. Papers B. P. Bishop Mus., 1 (3), 1901: 127 (type locality Guam).

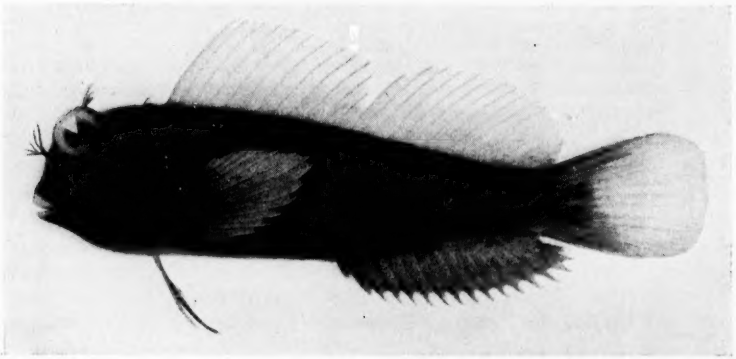
Salarias filamentosus Alleyne and Macleay, Proc. Linn. Soc. N. S. Wales, 1, 1877: 337, pl. XIV, fig. 1 (type locality Cape York); McCulloch and McNeill, Rec. Austr. Mus., 12 (2), 1918: 21, fig. 1, (based on holotype).

Salarias alboapicalis Ogilby, Proc. Linn. Soc. N. S. Wales, 23, 1899: 742 (type locality Lord Howe Island).

Exallias obscurus Borodin, Amer. Mus. Nov., 281, 1927: 1–2 (type locality Oahu Is., Hawaiian Islands).

Cirripectes indrambaryae Smith

Cirripectes indrambaryae Smith, Jour. Siam Soc. Nat. Hist. Suppl., 9 (3), 1934: 322 (type locality Koh Samui, Gulf of Siam).



Cirripectes indrambaryae Smith. From a photograph of a water-color drawing of the type by Luang Masya Chitrakarn of the Thailand Bureau of Fisheries; reproduced through the courtesy of Dr. Hugh M. Smith.

Dr. Hugh M. Smith kindly gave the author permission to reproduce here the photograph of a watercolor drawing of the type of *C. indrambaryae* Smith. The type was taken August 6, 1931, at Koh Samui, Gulf of Siam, by its describer. The water-color drawing was made by Luang Masya Chitrakarn of the (Siamese) Thailand Bureau of Fisheries.

UNITED STATES NATIONAL MUSEUM, WASHINGTON, D. C.

The Scientific Name of the Black Crappie [1]

By Reeve M. Bailey

RECENT authors have followed McKay (1881: 87) in applying the name *Pomoxis* [*Pomoxys* of McKay] *sparoides* (Lacépède) to the black crappie. A reexamination of the original description fails to justify McKay's judgment in resurrecting the name *sparoides* for the species.

Labrus sparoides Lacépède, (3, 1802: 449, 517–518, plate 24, fig. 2, and 4, 1802: 718), from "les eaux douces de la Caroline," was based, according to Cuvier (3, 1829: 88–89), solely upon a drawing sent to Lacépède by Bosc under the manuscript name *Perca notata*. The published figure is abominable, but obviously applies either to the *Centrarchus macropterus* or *Pomoxis sparoides* of recent authors. Since no type of *Labrus sparoides* was preserved the disposition of the name depends upon the poor figure and the description which was apparently drawn from this figure. The description itself applies much better to *Centrarchus macropterus* than to *Pomoxis "sparoides."*

In the figure the length and position of the dorsal fin agree closely with *macropterus* (its base projected forward extending far beyond the snout, as in *macropterus,* rather than to above the eyes as in *"sparoides"*). Likewise the position of the anal fin fits well with *macropterus* (its base projected forward extending to below middle of snout as in *macropterus,* instead of to below posterior margin of eye as in *"sparoides"*). In fact the figure of *Labrus sparoides* agrees much better with *macropterus* in this character than does the original figure of that species on the same plate. The numbers of dorsal and anal spines as given in the text (D. X, 12; A. X, 16; although I count D. X, 12; A. IX, 16 in the figure) agree far better with *macropterus* (D. XI to XIII, 12 to 15; A. VII to IX, 13 to 17) than with *"sparoides"* (D. VII or VIII, 14 to 17; A. VI or rarely VII, 16 to 20). The total numbers of dorsal rays (22) and anal rays (25 or 26) agree somewhat more closely with *"sparoides"* (D. 22 to 24; A. 23 to 26) than with *macropterus* (D. 23 to 27; A. 20 to 24), but the reproduction of the numbers of soft rays is perhaps erroneous since the pectoral exhibits 8 rays although neither species has less than 12 as a minimum count. In *"sparoides"* the vertical fin spines are much more sharply graduated in length than in *macropterus.* The outline of the spinous dorsal in the figure typifies that in *macropterus;* that of the anal is poor for either species but better represents *macropterus.* Although the species differ markedly in color pattern no diagnostic characters are evident in the figure. The great depth of the body and general body form agree better with *macropterus.*

In view of the utter inadequacy of this figure and description as applied to the *P. sparoides* of recent authors it would seem preferable to relegate *sparoides* to the synonymy of *macropterus,* despite the discomfiture resulting from a change in the name of a common species, rather than to have the

[1] This note is extracted from a manuscript revision of the Centrarchidae which was used in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the University of Michigan.

species forever masked under a name which is in all probability misapplied. This same conclusion was reached by Valenciennes (7, 1831: 459), but unfortunately McKay (1881) resurrected the name *sparoides* for the black crappie and subsequent authors have followed his lead.

LeSueur's manuscript name *Cantharus nigro-maculatus* was published in 1829 by Cuvier and Valenciennes (3: 65 [88–89] pl. 48), preceding by two years Valenciennes' description of the same specimen under the name *Centrarchus hexacanthus* (7, 1831: 344, 458–459). The figure and descriptions clearly apply to the black crappie. The type locality was given erroneously as Lake Huron in volume 7, but correctly as the Wabash River in volume 3, p. 88. The black crappie should therefore be known as *Pomoxis nigro-maculatus* (LeSueur), 1829. *Hyperistius carolinensis* Gill (1864: 92–93), a substitute name for *Pomoxis hexacanthus* Holbrook (1860: 39, col. pl. 6, fig. 1), is another synonym.

Pomoxis barberi Hildebrand and Towers (1928: 128–130, figs. 7–8) exhibits an extreme development of dark streaks along the centers of the longitudinal scale rows, a large eye, and a decrease in the bulk of the body giving the appearance of a large head and a thin "razor-backed" body. Such striking morphological modifications have been shown by Hubbs (1927) and Bailey and Lagler (1938) to accompany parasitism and malnutrition. Despite the great difference in appearance between *P. barberi* and normal *P. nigro-maculatus*, they are interpreted as specifically identical.

In summary: *Labrus sparoides* Lacépède, 1802, should be placed in the synonymy of *Centrarchus macropterus* (Lacépède), 1802; the scientific name of the black crappie, currently termed *Pomoxis sparoides*, should be replaced by *Pomoxis nigro-maculatus* (LeSueur), 1829; and *Centrarchus hexacanthus* Valenciennes, 1831, *Hyperistius carolinensis* Gill, 1864, and *Pomoxis barberi* Hildebrand and Towers, 1928, should be listed as synonyms of *P. nigro-maculatus*.

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Department of Zoology and Entomology, Iowa State College, Ames, Iowa.

Notes on the Flatfish *Engyophrys sentus* Ginsburg[1]

By William W. Anderson and Milton J. Lindner

Ginsburg (1933) describes *Engyophrys sentus* from a single specimen taken by the "Albatross" off Dry Tortugas, Florida, in 50 fathoms. As far as is known no other specimens have been recorded. The purpose of these notes is to make available more information concerning this relatively uncommon species than could be secured from the type.

During the operations of the U. S. Bureau of Fisheries' Ship "Pelican" in the littoral waters of the Northern Gulf of Mexico, 28 specimens of *Engyophrys sentus* have been taken with a small otter trawl.[2]

The 19 males, one of which was badly damaged, ranged in standard lengths from 40.5 mm. to 70.0 mm; the 9 females varied from 41.6 mm. to 70.8 mm. Two of the females were gravid; one from Station 42, taken on April 22, 1938, measured 53.7 mm. in standard length and the other from Station 143–2, taken on March 5, 1939, measured 70.8 mm. Spawning apparently occurs during the spring.

As described by Ginsburg, the teeth are in a single series in each jaw and there are no teeth on the colored side.

A number of our specimens of *E. sentus* possess a gradually tapering black papilla originating from the pigmented membrane above the pupil of each eye; that of the lower eye is generally longer and stronger than that of the upper. In 15 specimens in which one or both of the papillae exceeded 0.1 mm., the average length of the lower one was 3.1 mm. and that of the upper 2.0 mm; the longest papilla measured was 6.6 mm. An examination of Ginsburg's type disclosed the presence of a short stub of a broken papilla

[1] Published by permission of the Director of the United States Fish and Wildlife Service.

[2] 1 female, Station 42; 27°38′N, 96°32′W, 27 fathoms; 1 male, Station 93–9; 28°27′N, 92°16′W, 29 fathoms; 1 male, Station 94–1; 28°27′N, 92°13′W, 30 fathoms; 2 males and 1 female, Station 101–3; 28°30′N, 93°30′W, 25 fathoms; 2 males, Station 105–7; 28°17′N, 94°40′W, 25 fathoms; 1 male, Station 107–4; 28°05′N, 95°41′W, 27 fathoms; 7 males and 2 females, Station 113–8; 27°05′N, 96°51′W, 22 fathoms; 3 males and 3 females, Station 113–9; 27°05′N, 96°48′W, 29 fathoms; 2 males, Station 115–5; 26°42′N, 96°53′W, 25 fathoms; 1 female, Station 143–2; 29°49′N, 86°30′W, 40 fathoms; and 1 female for which there is no locality record.

on the upper eye and a trace of where the papilla had been broken from the lower eye. Seven specimens of *E. sancti-laurentii* (U. S. N. M. No. 41255, from "Albatross" Station 2805, 5 specimens; U. S. N. M. No. 94040, one specimen and U. S. N. M. No. 41269, one specimen) examined by us failed to reveal any trace of papillae.

All females of *E. sentus* had longer papillae than did the males. The shortest upper eye papilla was 2.7 mm. long in the females, and the longest corresponding papilla was 2.3 mm. long in the males. The average length of the upper papillae was 3.7 mm. in the females and 0.8 mm. in the males. The presence of these papillae appears to be a juvenile character that persists in the females and tends to disappear in the males. Of the 7 females and 18 males with unbroken upper papilla, 2 females and 10 males had standard body lengths greater than 60 mm. For fish smaller than 60 mm., the upper papilla averaged 3.4 mm. in the females, 1.5 mm. in the males; for fish larger than that size, it averaged 4.6 mm. in the females, 0.2 mm. in the males. Only

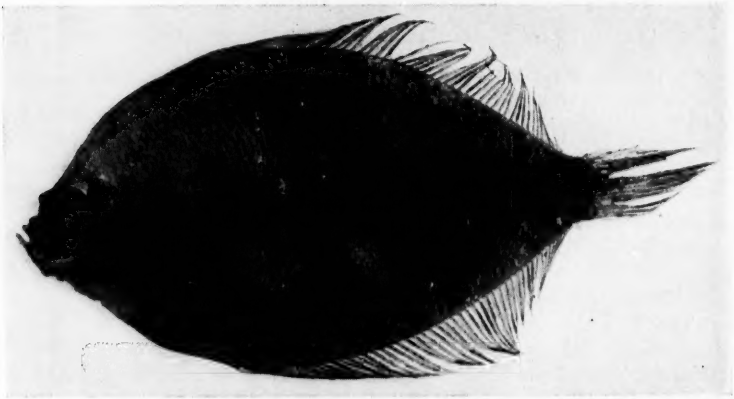

Fig. 1. Dorsal view of male *Engyophrys sentus* of standard length 62.8 mm.

one male above 60 mm. in standard length had a papilla longer than 0.1 mm. and no males under 60 mm. in standard length had a papilla shorter than 0.3 mm. Of the males longer than 60 mm., 2 had no trace of papillae on either eye and 2 had no trace of a papilla on the upper eye and only a minute stub on the lower.

We further find that the lengths of the papillae in the male of *E. sentus* are definitely related to the degree of coloration present on the blind side. The 18 males on which observations were possible were divided into two classes as follows: Class I, blind side immaculate or with faint coloration; and Class II, blind side definitely dusky. Class I, with 7 specimens, had an average upper papilla length of 1.6 mm., whereas in Class II, with 11 specimens, it averaged 0.2 mm.

Using the same color classifications, the average standard lengths of the males in Class I was 52.1 mm. and in Class II it was 62.3 mm. Only one

male (the smallest specimen with standard length of 40.5 mm.) and all of the females were immaculate on the blind side.

In specimens that are not immaculate on the blind side, there are from 3 to 7, usually 5 or 6, dark, diffuse, posteriorly curved transverse parallel bands on the anterior third of the blind side of the body. Similar but more pronounced bands occur in *E. sancti - laurentii.*

It appears probable from the above relationships that in *E. sentus,* ocular papillae and the absence of coloration on the blind side characterize the young of both sexes. These characters apparently remain unchanged in the mature female. The mature male, on the other hand, evidently nearly or quite completely loses the ocular papillae and develops coloration on the blind side. Since the only specimens of *E. sancti - laurentii* available were rather large, it is conceivable that during some stage of the development of this species there also may exist a period when the ocular papillae are present and the coloration on the blind side is absent.

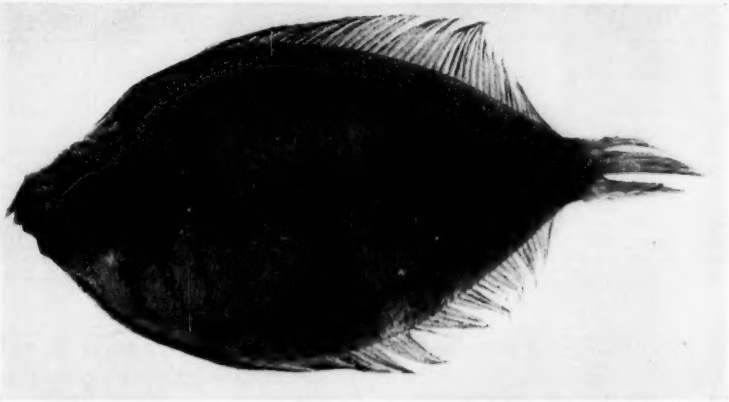

Fig. 2. Ventral view of male *Engyophrys sentus* of standard length 62.8 mm.

The color of the eyed side of *E. sentus* consists of a brownish background blotched with darker. Along the midline there are three rather large dark blotches as described by Ginsburg. Unpaired fins are lightish, irregularly speckled with darker.

The profile before the eyes in *E. sentus* is definitely concave, whereas in *E. sancti - laurentii* it is almost straight.

The dorsal fin rays vary from 74 to 83, the modal number being from 76 to 79. The anal fin rays vary from 60 to 67, with modal number from 62 to 64. There is a positive relationship ($r = +.80$; $P. < .01$) between the number of dorsal and anal rays. Those specimens having the greater number of dorsal rays also possess the greater number of anals.

The interorbital spines range from 3 to 5 with the mode at 4. The spines above the upper eye range from 1 to 4 with the mode at 2. The spines in front of the lower eye vary from 1 to 3 with the mode at 2. The variation in the spines is not due to sexual difference.

MEASUREMENTS AND COUNTS OF *Engyophrys sentus*

Sex	♂	♂	♂	♀	♀	♀	♀	♂	♂	♂	♀
Total length mm.	76.0	79.4	59.4	73.5	48.5	71.3	67.1	47.6	(2)	63.3	80.8
Standard length mm.	64.5	66.0	51.4	61.7	41.6	59.4	55.2	40.5	(2)	53.5	70.8
Depth mm.	34.4	35.3	24.5	31.4	20.0	29.2	30.3	19.8	(2)	26.9	40.0
Head length mm.	13.4	12.8	10.9	12.7	8.8	11.6	13.1	9.4	(2)	12.7	13.8
Maxillary length mm.	3.1	2.9	2.1	3.1	2.3	3.1	2.9	2.3	(2)	3.0	2.7
Length of papilla on upper eye mm.	1.7	(3)	1.3	4.4	4.6	(2)	2.9	1.7	(2)	2.2	4.7
Length of papilla on lower eye mm.	2.0	0.3	1.7	6.6	(2)	(2)	3.2	3.8	(2)	5.0	(2)
Diam. of lower eye mm.	3.8	4.7	4.0	4.7	3.8	4.4	4.2	3.2	(2)	4.5	5.0
Diam of upper eye mm.	4.4	4.7	4.0	4.7	3.6	4.3	4.3	3.4	(2)	4.4	4.5
Dorsal fin rays	80	79	79	81	76	81	82	80	(2)	75	77
Anal fin rays	64	63	64	64	63	65	65	65	(2)	61	62
Interorbital spines	4	5	4	3	3	3	4	3	4	4	4
Spines above upper eye	3	3	2	3	2	4	3	2	3	2	2
Spines in front of lower eye	2	2	2	2	2	2	2	1	2	2	
Gillrakers lower limb (1)	5	6	6	6	6	7	6	(2)	5	6	5
Gillrakers upper limb (1)	3	3	2	2	3	2	3	(2)	3	3	3

(1) First arch of eyed side. (2) Damaged.

In our series, which ranges in standard length from 40.5 mm. to 70.8 mm., as the specimens increase in size the depth increases more rapidly than the standard length. The coefficient of correlation between the two measures + .53. The probability is less than one chance in one hundred of such a correlation occurring fortuitously. The slope of the regression line is of sufficient magnitude to make depth an unreliable diagnostic character unless it is considered in conjunction with the length. No difference was found, in this relation, between the two sexes.

The maxillary in proportion to the standard length shows a significant negative correlation of — .56. The slope of the regression line is so slight, however, that throughout the range of specimens at hand the proportional decrease in maxillary length as the standard length increases can, for all practical taxonomic purposes, be disregarded. The males do not differ from the females.

The correlations of head length and diameter of the upper eye in proportion to the standard length show slight negative correlations of — .23 and —.33, respectively. Although one would normally expect such negative relationships to exist, these are not statistically significant due to the excessive variations in the small number of specimens available. Here again there is

MEASUREMENTS AND COUNTS OF *Engyophrys sentus* (*Continued*)

♀	♀	♂	♂	♂	♂	♂	♂	♂	♀	♂	♂	♂	♀	♂	♂	♂
80.8	64.0	65.0	76.6	79.0	82.0	70.8	81.3	60.3	71.4	61.0	56.8	56.2	74.4	58.1	66.3	77.1	73.5
70.8	53.7	57.2	62.8	66.2	70.0	61.0	69.4	50.5	58.7	50.1	46.6	46.7	61.2	46.7	56.0	62.3	62.3
40.0	27.8	26.6	33.2	35.9	40.0	31.1	34.4	25.9	32.4	27.2	23.3	23.9	33.7	23.3	29.2	33.7	37.7
3.8	10.6	11.3	13.4	15.6	15.6	13.1	13.8	11.3	12.8	12.3	9.4	9.9	13.3	9.8	12.2	12.8	13.8
2.7	2.9	2.5	2.8	3.1	3.2	2.9	3.2	3.2	3.6	2.9	2.6	2.7	3.4	2.5	3.0	3.4	2.9
4.7	3.1	(2)	(4)	(3)	(3)	(4)	(3)	2.1	0.3	3.7	1.7	0.4	(4)	2.7	2.3	(3)	(4)
(2)	3.1	(2)	(4)	(3)	(3)	(3)	(3)	2.5	0.8	5.9	3.3	0.7	(4)	4.6	3.4	0.8	(3)
5.0	4.5	4.3	5.3	5.0	6.1	4.9	5.4	4.2	4.9	4.9	3.6	3.9	5.3	3.7	4.5	4.8	5.2
4.5	4.2	4.2	4.8	5.0	6.3	4.7	5.3	4.2	5.0	4.2	3.4	3.5	5.1	3.5	4.4	4.9	5.1
77	78	78	79	78	75	83	75	76	78	74	79	76	79	76	76	78	(2)
62	64	63	61	62	62	67	61	61	62	60	64	62	66	63	63	62	62
4	4	4	3–5	3	4	3	4	4	4	4	4	3	4	3	4	4	4
2	2	2	2	2	2	3	4	2	2	3	2	1	2	2	3	4	2
	2	2	2	2	1	2	2	2	2	2	2	1	2	2	2	2	2
5	5	5	5	(2)	6	4	5	6	6	7	5	4	6	4	5	4	4
3	3	0	3	(2)	0	0	2	3	3	2	1	3	0	0	2	0	0

(3) Small knob less than 0.1 mm. in length. (4) No trace of papilla.

no sexual difference and the slopes of the regression lines are so slight that they can be disregarded for taxonomic comparison through this range of standard lengths.

The gillrakers on the lower limb of the first arch of the eyed side range from 4 to 7 with 5 and 6 the most prevalent. Those on the upper limb of the same arch vary from 0 to 3 with 0 and 3 being the most frequent numbers encountered.

One specimen was found to have been feeding upon copepods.

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SHRIMP INVESTIGATIONS, UNITED STATES DEPARTMENT OF THE INTERIOR, BUREAU OF FISHERIES, NEW ORLEANS, LOUISIANA.

A Totally Ambicolorate Flounder, *Platichthys stellatus*, from Alaskan Waters

By E. W. Gudger

ALBINISM and ambicoloration, common abnormalities in the coloration of flatfishes, are not unusual in those species of *Platichthys* found on the European coast from the White Sea to the Straits of Gibraltar, and throughout the Mediterranean Sea and its subdivisions. But, so far as I know, ambicoloration has never before been described in *P. stellatus*, which ranges the North Pacific from southern California to Japan. Recently an interesting totally ambicolorate specimen was sent to me by Dr. Carl L. Hubbs, who collected it in Alaska, where it had been caught 15 or 20 miles off Petersburg.

As it lies before me, this flounder measures about 12.5 inches. Before dissection and shrinkage from preservation, it probably measured about 13.5 inches over all. The normal weight of course cannot be ascertained, but, since the fish attains a weight of 15 to 20 pounds, this specimen is plainly a young one. It is a true ambicolorate flounder, being as dark on the left or lower side as it is on the right or upper side. Furthermore, the dark bars and splotches of the right side are almost identically reproduced on the left. This is the most perfectly ambicolorate flatfish I have ever examined.

It is most unfortunate that, in the process of cleaning the fish for freezing, the head and abdomen had been cut up badly. This of course makes it impossible to have a photograph or a drawing made. Fortunately, however, the left or rotating eye escaped the knife. This eye is barely over the median ridge. Indeed its outer or left edge is barely clear on the right of the median line. This incompletely rotated eye has produced the other always associated deformity—the hook at the anterior point of the dorsal fin. Either the hooked point got its final growth settled while the eye was migrating across the mid-dorsal line, or else the incompletely rotated eye in its permanent position just across this line inhibited any further forward and downward growth of the interior part of this median fin.

It must be emphasized that total ambicoloration in flatfishes is always accompanied by a dorsal fin hooked at the anterior part and by an incompletely rotated eye. However, these head anomalies may occur with only partial ambicoloration, but so far as I know they are never present unless there is partial coloration below. Fortunately I have been able to study a series of flounders showing perfect gradation from very little color on the lower side to the perfect condition of ambicoloration called "black belly." Every one of these fish, from the least colored to those completely dark on the under side, had a hooked dorsal and an incompletely rotated eye.

Thus Gudger and Firth in 1936 described a *Paralichthys oblongus* having the hinder two-fifths of the lower side colored like the upper side but lacking head anomalies. Another fish of the same species had the head anomalies but only about one-fifth (the extreme hinder part) of the lower surface colored. Another with the head anomalies had the hinder two-fifths of the lower side colored like the upper. In 1935 they described a halibut, *Hippo-*

glossus hippoglossus, with head anomalies and all dark underneath save the hinder half of the tail and the left (lower) pectoral, and the middle region of the lower head. In 1936 Gudger described a reversed almost totally ambicolorate *Paralichthys dentatus* with head anomalies and coloration exactly like the upper side except that the lower pectoral fin and the forward two-thirds of the lower head were white. Then in 1934 Gudger described a *Pseudopleuronectes americanus* with head anomalies and all the lower surface colored except about half the lower side of the head. Next is a totally or bilaterally colored *Paralichthys lethostigma* with head anomalies described by me in 1936. And now comes the black-bellied *Platichthys stellatus*, a perfect parallel, in coloration and head abnormalities, to the preceding fish.

The causal relationship of hooked dorsal fin and incompletely rotated eye are of course understandable, but why these are always accompanied by coloration on the lower or white side varying from little to complete, is a great enigma. Later I hope to make a study of all known cases in the endeavor to find a solution.

This is the only specimen on record of *P. stellatus* having any degree of ambicoloration. Dr. Hubbs writes that Mr. Ohmer, from whom he had obtained the specimen, has handled many thousands of flounders of this species from this vicinity, but he does not recall ever having seen such a bicolored specimen as this. However, one of his employees alleged that he remembered seeing another of the kind some time in the past, but whether it was totally or partially ambicolorate was not stated. Furthermore Dr. Hubbs has handled hundreds if not thousands of this particular fish all the way around the north Pacific from California to Japan, without ever seeing an ambicolorate specimen. This is a most extraordinary fact in view of one to follow. All flatfishes are given not only to marked variations in coloration, with the attending head anomalies in extreme cases like that under consideration, but also to reversal of the side on which the fish rests on the bottom of the sea. This reversal of sides is extremely common as I have shown (1935).

However, of all the flatfishes known to science, none goes to such far extremes of reversal as does *Platichthys stellatus*. On this matter, J. R. Norman of the British Museum in his great "Monograph of the Flatfishes" (London, 1934: 28) has this to say of reversibility in *P. stellatus*: "Prof. Hubbs has pointed out to me in a letter that in Japan he found (the dextral) *Platichthys stellatus* invariably reversed (i.e. sinistral), whereas in California the number of dextral and sinistral individuals was about equal, and in material from Alaska about 75 per cent of the fishes were reversed. The material in the British Museum, although small in numbers, bears out this conclusion."

This paucity of variation in the matter of coloration in the North Pacific flounder is all the more remarkable in a flatfish so indifferent as to which side it lies upon, whether right or left, that one prominent ichthyologist has suggested that it might well be called "ambidextrous"—50% right and 50% left in California waters; 25% right and 75% left along Alaska shores; and practically 0% right and 100% left in Japanese waters.

The flatfishes are the most unusual and anomalous of fishes. In youth

they swim and feed in a vertical position as do ordinary fishes; but in adult life they lie on the bottom—not on the belly, but on one side. This side is white and eyeless—its eye having migrated to the upper side which thus possesses two eyes and all the color. Thus flatfishes are abnormal fishes whose usual abnormalities are entirely normal. But because they are essentially abnormal, they are subject to great variability in the matter of which side is below, in the matters of coloration, position of the migrating eye, and hooked dorsal fin. *Platichthys stellatus,* on the other hand, in the vast abundance of its known reversed specimens and in the extreme paucity of its known ambicolorate specimens, is the most anomalous and unusual of the considerable number of teratological flounders which I have been privileged to study.

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American Museum of Natural History, New York.

Sur le Squelette d'un *Cynoglossus* Indo-Pacifique

By Paul Chabanaud

L'EXAMEN partiel du squelette d'un *Cynoglossus bilineatus* [Lacépède] m'a permis de faire diverses remarques d'un grand intérêt.

Le spécimen, d'origine inconnue, mesure 190 millimètres de longueur totale et 175 millimètres de longueur étalon. Ses caractéristiques sont les suivantes: D 116. A 92. C 9. V n 4. S *c a* 100. Entre les deux lignes latérales, on compte 16 écailles sur la face zénithale et 20, sur la face nadirale. Il a, pour formule rhachiméristique: *a* 10 [4 + 6] + c 46 = *t* 56.

De même que chez tous les Cynoglossidae, la brachyconie prosotrope est extrèmement prononcée: le cône cranial de chaque périchorde est plus de moitié plus court que le cône caudal, sauf cependant aux toutes premières vertèbres abdominales, où l'intensification, de l'arrière vers l'avant, ne la contraction axiale annihile progressivement la différence.

La vertèbre *a* 4 porte, du seul côté zénithal, une courte hémapophyse libre. A partir de *a* 5 inclusivement, les deux hémapophyses sont parallèles entre elles, s'inclinant proximo-distalement vers l'arrière. A chaque vertèbre, ces hémapophyses paires sont réunies par un pont transversal, qui fait

exceptionnellement défaut à la vertèbre *a* 6. Ce pont osseux affecte la forme d'une cloison verticale, dont le bord dorsal, délimitant le canal hémal, est rectiligne, tandis que le bord ventral est concave et d'autant plus profondément que la vertèbre occupe un rang plus éloigné du crâne. Les hémapophyses s'allongent progressivement, de l'avant vers l'arrière du rhachis, ne dépassant que fort peu le bord ventral du D 77 –102, A 70–89. Les pores de la ligne latérale sont aussi en quantité un peu plus forte: 115, au lieu de *c a* 100; mais la différence de ce chef est peut-être plus apparente que réelle, car ce sont les séries transversales d'écailles, plutôt que les pores eux-mêmes, qui avaient retenu mon attention. Il est toutefois regrettable que, faute d'avoir consulté mon travail, M. Kuronuma ait négligé de nous renseigner sur le galbe du profil rostral, ainsi que sur la profondeur de l'émargination des membranes connectives amphiuriques, deux points de la morphologie des *Aesopia* auxquels l'étude d'une cinquantaine d'individus m'a incité à accorder une haute valeur discriminative.

Dans ma revision de 1934 (*op. cit.*), j'ai adopté la classification suivante, en ce qui concerne les deux formes décrites des Seychelles: *Solea tubifera* Peters, 1876, simple natio de *Aesopia heterorhinos* Bleeker; *Solea borbonica* Regan, 1905, également simple natio, mais de *Aesopia microcephala* Günther, 1862. Tout bien pesé, il me semble que les deux formes en question représentent une seule et même espèce, *Aesopia tubifera* [Peters] (= *Solea borbonica* Regan), caractérisée par l'absence (unique dans le genre *Aesopia*) de bandes transversales sombres, ces dessins étant remplacés par des marbrures plus ou moins apparentes. La formule actinoptérygienne est D 77–86; A 66–68. Le profil rostral est plus ou moins largement incurvé. Les membranes connectives amphiuriques sont profondément émarginées, au moins jusqu'à la motié de la longueur du rayon terminal de la notoptérygie, comme de celui de la proctoptérygie. A n'en juger que d'après la formule rhachiméristique de "*Solea borbonica*," 9 + 36 = 45, *Aesopia tubifera* serait plus voisine de *Aesopia heterorhinos* que de *Aesopia microcephala*.

Muséum National D'Histoire Naturelle, 57 Rue Cuvier, Paris.

Sur la Classification et la Géonémie des Soléidés du Genre *Aesopia*

By Paul Chabanaud

DANS un travail publié en 1934[1], je crois avoir montré à quelles difficultés se heurte la discrimination des espèces qui, dans la famille des Soleidae, composent le genre *Aesopia* Kaup, 1858, ce genre ne me paraissant

1 Bull. Soc. Zool. France, 59, 1934: 420–436.

comprendre que 2 espèces réellement distinctes, *Aesopia heterorhinos* [Bleeker, 1856] et *Aesopia japonica* Bleeker, 1869. J'ai cru devoir leur rapporter respectivement tant à titre de sous-espèces, qu'à celui de nations ou de simples morphes, 4 formes décrites sous des noms différents. A en croire le matériel que j'ai eu alors sous les yeux, *Aesopia heterorhinos* se trouverait aux îles Andaman et serait répandu à travers l'Insulinde, jusqu'à l'Australie inclusivement, comptant en outre une sousespèce à l'île Maurice; *Aesopia japonica* existerait aussi aux Seychelles, ainsi que sur les côtes du continent Australien, mais étendrait son habitat vers le Nord, jusqu'à Yokohama.

Récemment, M. Katsuzo Kuronuma a décrit,[2] comme appartenant à la première de ces deux espèces, *Aesopia heterorhinos,* un spécimen capturé à Okinawa (archipel des Riu-Kiu), localité qui, dans le Pacifique, étend considérablement vers le Nord l'habitat de cette forme insulindienne. La description mentionne D 103, A 90, nombres qui élèvent, l'un et l'autre, d'une unité le maximum que j'avais indiqué pour les rayons de ces mêmes nageoires, soit pont transversal, à la vertèbre *a* 5, tandis qu'à la vertèbre *a* 10, leur partie libre devient au moins égale à la hauteur même du pont hémal, celui-ci ne se développant que sur la partie proximale des hémapophyses. La partie libre de celles-ci se prolonge de part et d'autre du rein.

L'hémacanthe de la 1ère vertèbre caudale ($c\ 1 = t\ 11$) présente, du seul côté zénithal, un processus acuminé, orienté verticalement, et braquant ventralement, qui figure une hémapophyse distalement libre et semblable en cela aux hémapophyses abdominales.

Aux périchordes *a* 2, *a* 3, *a* 4 et, probablement aussi, *a* 5 est attaché, du côté zénithal, un court métamyoste.[3]

Le métamyoste des vertèbres *a* 2 et *a* 3 est épaxonal; celui de *a* 4 est isaxonal; celui de *a* 5 (accidentellement détaché) paraît hypaxonal. Du côté zénithal tout au moins, les somites suivants ne comportent aucun rudiment de squelette intermusculaire.

Au point le plus saillant de sa convexité caudale, c'est-à-dire au niveau de la commissure operculo-clithrale, chaque clithrum présente une apophyse constituée par un processus en forme de courte baguette, orienté rostro-caudalement, autrement dit perpendiculairement à l'axe du clithrum, et qui renforce une expansion triangulaire de la crête de ce même clithrum, dépassant légèrement l'angle au sommet du triangle osseux. Pas d'alinéa ici. Cette apophyse, aussi développé sur la branche nadirale de la ceinture scapulaire que sur la branche zénithale, paraît devoir s'interpréter comme le vestige du basipterygium thoracique, secondairement coossifié avec le clithrum.

L'ischioptérygie nadirale, totalement séparée de la proctoptérygie, est soutenue par un long basipterygium osseux, dont l'extrémité mésale se trouve brièvement en contact avec la face cuticulaire du clithrum nadiral. Il n'existe aucun vestige d'ischioptérygie nadirale.

MUSÉUM NATIONAL D'HISTOIRE NATURELLE, 57 RUE CUVIER, PARIS.

2 The Zoological Magazine, 51, 1939: 783.

3 Os intermusculaire. Dans l'impossibilité où je me trouve présentement de parachever ma dissection, force m'est de renoncer au contrôle de la morphologie de l'hémisome nadiral.

Notes on the Sailfish, *Istiophorus americanus* (Lacépède), in the Western Gulf of Mexico

By J. L. BAUGHMAN

PISO (1648), in his *Historia Naturalis Brasiliae,* gives a rough plate that it is possible to identify as the Atlantic sailfish, *Istiophorus americanus* Lacépède. This is accompanied by a short description in which the author, Marcgrave, names it as *Guebucu brasiliensibus.* There was no systematic description of any of the genus, however, until Broussonet (1786), working from an East Indian specimen in the British Museum, described it as *Scomber gladius,* recognizing its affiliation with the mackerels. Later Lacépède (1803) established the genus *Histiophorus* for the reception of the species. Cuvier and Valenciennes (1831) ignored Broussonet, and assigned the name *Histiophorus indicus* to the British Museum specimen, and established another species, *Histiophorus americanus,* on the strength of Marcgrave's description, thus differentiating the American form from that of the Indian Ocean. None of these authors, with the exception of Marcgrave, had opportunity of examining the Brazilian specimen; yet it seems to have been conceded from the description given by him that this fish deserved separation from the Oriental fish of the genus. However, Günther discarded the name *americanus* and assumed the Atlantic fish to be identical with that of the Indian Ocean.

Most of the confusion originated through lack of sufficient material, and though De La Sagra (1853) and Poey (1858) both stated that the fish was to be found about Cuba, and Schomburgk (1848) included it in his list of fishes of Barbadoes, it was not until 1872 that any modern ichthyologist had opportunity to examine a specimen. In that year a skeleton and plaster cast from a fish taken at Newport, Rhode Island, were presented to the National Museum. In March, 1878, 2 more were taken from a boat running between Savannah, Georgia, and Indian River, Florida, and were brought to the Savannah market, where they occasioned much comment. In 1873 a mutilated specimen was brought from Key West to New York.

This constitutes the earlier history of the species, as given by Goode (1880). Little was known about the fish for a good many years more, and it was not until the beginning of its popularity as a game fish that further information was acquired. The greatly increased interest in this type of angling has made available much data, particularly with regard to its range and seasons of occurrence. The following material, compiled on the Texas coast, has not been, as far as can be determined, recorded prior to this note. Combined with it is some material from the waters to the east and to the south.[1]

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[1] I am indebted to Mr. Stuart Adkins, San Benito, Texas; to Mr. J. G. Perkins, Port Isabel, Texas; to Mrs. Lyle McCaleb, Port Aransas, Texas; to Mr. J. H. Martinez, Merida, Yucatan; and to Mr. E. J. Hofius, of Belize, British Honduras, for much of the information contained herein; and to Miss Alice Dean, Librarian, and Dr. Asa C. Chandler, of Rice Institute, Houston, for use of their fine library. To all of them are due my heartiest thanks.

History of Texas Occurrences

There is an apocryphal tale that many years ago a sailfish was taken off Freeport, Texas, by a woman, trolling for kingfish. The first appearance on which there is any accurate data was that of July 9, 1934, when a specimen was taken a short distance offshore at Port Isabel, Texas. The same year a second fish was boated at Freeport, and on June 28, 1935, the third was taken off the coast between Galveston and Freeport. In 1936 Port Isabel accounted for another specimen, and several were reported from Galveston and Freeport. Sixteen were taken at Port Isabel in 1937, 15 in 1938, 10 in 1939. During the same years Galveston and Freeport continued to report the species, but not so consistently, nor in such large numbers. At Aransas Pass 7 were caught in 1938, and 8 in 1939. In 1940 there was a heavy increase in the catches along the entire coast, and at the time of this writing (August 20, 1940) captures at each of these ports were far in excess of any previous year. The area covered by these occurrences roughly coincides with the line of coral reefs which parallel the entire Texas coast, but lying a little inside of these, between the reefs and the coast. At Port Isabel sailfish are more common than at any other portion of the territory, probably because of the proximity of the Gulf stream (here about 40 miles) to the coast. In this area they have been seen and taken all the way from the "Twenty-four-ten Bank," in Latitude 24° 4′ N., about 140 miles south-east of Port Isabel, to the snapper banks lying about 40 miles north-east of that place. Several have been taken within sight of the shore, while others have come from as far out as 50 or 60 miles. During the 1940 Fishing Rodeo nearly all the fish were taken inside the 18 fathom line, at a distance not more than 12 miles out.

At Port Aransas the fish have been taken less frequently, probably because prior to this year there have been few boats which fished the offshore waters. However, they have been reported from Hospital, Baker and Aransas reefs, and, in 1939, fifty or sixty were reported from between these reefs and the sea buoy, about 4 miles from the jetties on Mustang Island.

Freeport fish are generally encountered by the kingfish boats, en route between the line of reefs known as the East, West and Middle Banks (about 12 miles offshore) and the Thirty-two Mile Bank, which as its name implies, lies about 32 miles southwest of Freeport.

Between Galveston and Freeport, boats occasionally encounter sailfish. At Galveston most of them are reported by boats running between that port and Heald Bank, which lies 45 miles south. These boats, fishing for kingfish (*Scomberomorus cavalla*) and red snapper (*Lutianus aya*) make the run regularly, and numbers of sailfish have been taken from them by anglers trolling feather jigs for kingfish. They are also reported from the Claypile, about 80 miles south. The captain of the old Heald Bank Lightship, which was removed some years ago, is said to have seen large numbers of these fish at times, but this information is indirect. However, occurrences at Galveston appear to be less frequent than they are further south along the coast.

From Port Arthur, Texas, only one fish is reported. This was taken on a hand line from one of the tankers that operate out of that port, and came from the Sabine Bank, which lies about 40 miles out.

In addition to these I have reliable reports of the occurrence of the sailfish at Mobile, Alabama; off the coast of Yucatan (on the Campeche Bank); and at Belize, British Honduras.

Natural History

The earliest recorded appearance of Texas sailfish in the spring is May 2, 1938. The latest appearance in the fall is November 11, 1939. Both these dates are from Port Isabel. The earliest date on which they were reported in the Freeport-Galveston area was late May, 1935, when one was reported from the Heald Bank, off Galveston. The latest appearance from the same area is September 7, 1937. These dates for the northern area are unusual, for as a rule they do not reach this part of the coast till the early part of June. Beginning with this period, however, they are present throughout the entire summer.

Size.—A wide range of size is exhibited, although no very small specimens have ever been taken in this locality. The smallest, one of 25 inches, was taken at Freeport on July 6, 1940. Another of 30 inches taken some years ago weighed 17½ ounces. One of 41 inches also came from there, as did another that measured 49 inches and weighed 8½ pounds. Two other examples that were less than 4 feet in length were taken at Galveston on August 16 or 17, 1940. Judging from the Freeport fish these should weigh less than 8 pounds. The largest so far, a Port Isabel fish, measured 96½ inches in length, and weighed 94 pounds after having been out of the water twenty-four hours. This is very nearly a record for the species, although Mr. J. V. Rogers of Galveston, Texas, reports an 11 foot specimen taken from a snapper boat, some years ago, while en route to the Campeche Bank. He believed that it would weigh over 125 pounds.

Abundance.—The fish seem to be numerous and to have always been so. The peak of seasonal abundance appears to be in the latter part of July and the early part of August.

Color.—According to Mr. Adkins, the color of the Texas fish agrees with that of the Florida specimens, except for the fact that the colors are a blending of royal blues, rather than purples. He also says that there is a bronze colored fish, not nearly so abundant. Two of these were taken in 1939, and three in 1940. From statements by Mr. Adkins, and from an excellent photograph of one of these fish, the following notes were made. "Bill longer than in ordinary fish; head more slender. Spots on sail are scarce, not over half a dozen being present; sail, royal blue; dorsal surface of body royal blue, shading into bronze which extends clear down beneath the belly. Dorsal surface of the body fuller and more rounded, while the placement of the pectoral fin and its shape differ slightly from the ordinary sailfish, the ventral edge being almost parallel with the line of the belly, while in the common sailfish this fin appears to form a somewhat acute angle. Tail coloration is darker, and there is no extension of the body silver on the fins. Vertical stripes very faint."

Small specimens of the common sailfish were quite silvery in color, with only an indication of blue on the dorsal surface, although the dorsal fin was colored much as it was in the adult fish.

FOOD.—Three fish, which Mr. G. B. Skelton, of Port Aransas, took from the same school, had all been feeding on sardines (*Brevoortia* sp.). Stomachs taken from the Port Isabel fish have disclosed shrimp, mullet and menhaden, as well as some unidentified fishes. The majority of the contents have been shrimp, however. Walford says that the Pacific species feed on mackerel, sierra, sardines, mullet and squid.

SPAWN.—Several female fish taken late in the season have had spawn running from them. Of the 18 fish taken at Port Isabel between August first and third, inclusive (1940), 17 were females, with roe in all stages of development. Two of them, according to Mr. Adkins, looked as though they might spawn in a short time, while in the largest fish the ova had just begun to form. Walford says that the Atlantic species spawns in late June, July and August, probably not far from shore, for schools of young are seen the following winter. This bears out Mr. Adkins, and agrees with Hunt, who states that numbers of tiny sails are present in Florida waters during part of the year, and mentions 3 small sailfish which were taken from the stomach of a dolphin in February.

NATURAL ENEMIES.—Mr. Skelton once told me that he had taken small sailfish from the stomach of a dolphin, but did not amplify the statement. The most interesting comment on the natural enemies of the sailfish comes from the column of Jimmie Lingan, Houston Chronicle sports editor. On August 14, 1940, he quotes Mr. Adkins as follows:—

"We were offshore in twenty-three fathoms when we saw a sailfish jumping about half a mile from us. We reached the spot just in time to see about six porpoise work him over. They would knock the sailfish out of the water, first head, then tail, first. The last we saw of this sailfish was his tail in the mouth of a porpoise about twelve feet long. They cut that sailfish up before I could get my camera set up to take a picture."

On my writing Mr. Adkins in this regard, he confirmed the statement, and identified the porpoise, from a plate in the National Geographic Magazine, as the bottlenose dolphin, *Tursiops truncatus*.

AGGREGATIONS.—A gregarious habit has been noted by Hunt (1935) who remarks that the young congregate in schools; and various other writers have commented on the mature fish having a like habit. Snapper boats at Port Isabel reported large numbers of sailfish on September 25, 1940, but only one group of 3. Later, on October 12, they again reported large numbers present, running through 6 to 8 aggregations of a half dozen each; these fish were about 40 miles N.E. of the port.

ECONOMIC USES.—Thomas Aitken, writing in the Stuart Fishing Guide, says, "One last word about the sailfish — he is excellent for food. You will find fresh sailfish steaks comparable to the famed swordfish steaks of the upper Atlantic seaboard. Smoked, the flesh has a flavor relished by epicures."

Confirmation of this comes from Mr. Martinez, who says that they are relished as food by the people in his locality, first being dried and salted. In describing the meat he makes the statement that the seamen like the fish greatly, as it has "grease in layers." Evidently it is somewhat more fatty than most fishes. The oil of the fish is used for leather dressing.

Conclusions

From the foregoing, and from other miscellaneous information, it would appear that sailfish in Texas waters work north along the Gulf stream in the spring, and that as the shore waters become warmer, they work in from it towards the reefs closer inshore.

The very early and very late occurrences at Heald Bank may possibly be accounted for by the fact that that Bank lies in the same relative position to the Gulf stream as does Port Isabel, thereby producing the same set of conditions as found much (nearly 400 miles) farther north. Since Freeport lies closer in, it takes the fish longer to work in to the waters around those banks. Conditions at Port Isabel are roughly the same 30 days earlier and 30 days later than at Freeport.

The small catch of the first year, and the later increased catches do not reflect changes in the abundance of this fish, but rather changes in the number of boats fishing for them.

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Ichthyological Notes

VERTICAL DISTRIBUTION OF FISHES IN SHALLOW COASTAL WATERS.—The matter of the vertical distribution of fishes in shallow coastal waters, especially on the Gulf Coast of the United States, has been given new importance by the current proposal of the Army to close most of the Texas coastal waters and use the area as a bombing range.

Pearson (U. S. Bur. Fish., Inv. Rept. (10), 1932) noted that pelagic fishes were often taken in the winter trawl fishery off Virginia and North Carolina. The writer (Gunter, Amer. Nat. 72, 1938: 77–83) found the situation much the same in the shrimp trawl catches in shallow water on the Louisiana Coast. It was concluded that there is strong indication that large numbers of fishes, pelagic species and plankton feeders included, are often near the bottom. Against this, the criticism has been made that many of the fish, especially the pelagic ones, may have been caught in the upper water layers as the trawl was being raised. Several facts stand as a refutation of this criticism. The trawls from which the Louisiana data were collected were raised by hand. Under these conditions the trawl is collapsed and it moves so slowly through the water that any fish can avoid it. Furthermore, Beebe's (Science, 80 (2083), 1934: 495–496) observations from the bathysphere indicated to him that trawls are not efficient in clear water. He was referring to a trawl being pulled through the water and not on the bottom. The writer also, inadvertently and through error, got evidence on the same point. More than twenty-five hauls were made 12 miles off Barataria Pass, Louisiana, with a shrimp trawl for which insufficient rope had been paid out. The trawl pulled well and now and then it touched bottom for mud was scraped up by the runners of the trawl boards. Only once or twice were small numbers of fish and shrimp taken, and this must have been during the few occasions when the trawl touched bottom. Later, when the ropes were lengthened, good catches were always made. This means that one of two situations existed. Either the trawl is much more efficient in the turbid water near the bottom than it is in the clearer waters above, or the fish are nearly all on the bottom. Possibly a combination ot both factors was at work.

Regardless of what the numbers of fishes in the upper water layers may be relative to the numbers on the bottom, the above-related situation, where fishing took place only on the bottom, leads to the unavoidable conclusion that large numbers of fishes, including pelagic and plankton-feeding forms, are always present on or very near the bottom.

There are several reasons why the bottom would be attractive to fishes in littoral waters. In the bays and estuarine areas many marine fishes are probably drawn to the bottom by the greater salinity of the water there. The bottom water is a little more murky than that of the layers above and serves as some protection. It is also darker than in the upper regions and fishes there are in the advantageous position of being in the dark looking at the light. A fish on the bottom only has to watch half instead of all of a sphere for enemies. If most fishes are on the bottom, most enemies will approach in only one plane. Whether or not fishes have the instinct or intelligence to make use of such factors may be debatable, but competition for survival is extremely intense in this well-populated environment and I am inclined to believe that successful species have long since "learned" to use such advantages. Another factor attracting fishes to the bottom, and probably the chief one, is food. Many worms, mollusks, crustaceans and other food organisms live on the bottom, and there is more food here than at any other plane, at least in littoral waters.

Since the greatest concentration of marine life is on the bottom layers in shallow coastal waters, a bomb dropped in shallow water where its shock will be transmitted to the bottom will kill much larger amounts of fishes and other marine life than a bomb dropped in deep water. I have recommended that no live bombs be dropped within 12 miles of the Texas Coast. This is little enough limitation, for the bottom along most of the Gulf Coast slopes down very gradually. In Texas the rate is at about a fathom to a mile, so that at 12 miles offshore the depth is only about 70 feet.—GORDON GUNTER, *Game, Fish and Oyster Commission, Rockport, Texas.*

NOTES ON TWO AFRICAN FISHES.—In October, 1936, I purchased, from the General Biological Supply House of Chicago, two African lungfishes (*Protopterus annectens* Owen) which were then about 9 inches long. These specimens are now almost 24 inches long and are still growing steadily. They have been kept in aquaria with the water temperature at about 75° and have fed regularly, summer and winter, with irregular periods when, for some reason or another, they do not appear to be as avid for their food as usual. At these times one or more of the ambulatory fins have shrunk or been resorbed until the fin was reduced to a mere stump. Then, all of a sudden, the fin would begin to grow and shortly reach normal length again.

On the last occasion when this took place, the regenerated fin grew out bifid and for over a year one of the specimens has had a biramous pectoral, each of the filaments being about an inch and a half long.

While the increase in their length has thus been roughly 166 per cent, the increase in weight, which is at present 5¼ pounds, represents nearly 1000 per cent increase over the weight when they were first received.

I imagine there may be records on the rate of growth in *Protopterus* but for these I have not searched the literature. It simply occurred to me that a note on our specimens might be of interest.

I recall the mounted example in the Coryndon Museum, Nairobi, which I saw in 1934, as being something over 5 feet in length. This was supposed to have been the largest example on record, if I quote Dr. V. G. S. van Someran correctly.

Mr. Loveridge called my attention to an interesting account of methods of capturing lungfishes when the swamps are dried up, which was published by Mr. R. J. Cunninghame and which appeared in the *Journal of the East African and Uganda Natural History Society* (4, No. 7, Dec., 1913: 82).

I had always labored under the impression that *Calamoichthys* was a rare fish until I saw a large number of them on exhibition while on a visit to the Aquarium of the London Zoo in late August, 1936. Doctor E. G. Boulenger told me that he secured these from a steward on one of the Union Castle Line ships on the West African run that stopped for a considerable time at Lagos. The collector found these most interesting little fish in drainage ditches right along the sides of streets within the great spread-out city of Lagos.

I returned to Cambridge and it occurred to me that these would make most interesting pets. I knew that the Zoological Society of London had sent several to the New York Aquarium and that they seemed to live well in a relatively small tank. I then communicated with Doctor Julian Huxley who sent two specimens to the New York Aquarium to be forwarded to me. About this time I saw that the New York Aquarium also had a considerable number and Mr. C. W. Coates very kindly let me have three of theirs, so that five specimens ultimately reached the Museum of Comparative Zoology.

In New York these little fish had been fed exclusively on tubifex worms. The culture of these worms in the Biological Laboratory having run out, we tried brine shrimp and enchytraeids which were refused. Crushed snails, however, proved promptly acceptable and then, being uncertain whether we could get these in winter, we started cutting small gambusias into one or two pieces. The stock of these is readily bred and our little reed fish have thrived on a steady diet of small, cut up cyprinodonts of various sorts.

These five specimens reached us in July, 1937. One died within a few months. The others are flourishing today. They are exactly the same size as they were when they were received; namely: 10½ inches.

They are extremely attractive at all times, swimming about with a slight lateral undulation of their long eel-like bodies and an extremely rapid rotary paddling motion of the short, round pectoral fins which are situated very far forward. Each of these has a large conspicuous black spot edged by the pale straw color which is the general ground color of the whole fish.

I cannot observe that the dorsal finlets are capable of being depressed; at least, they never seem to be so, and the tail plays but little part in locomotion beyond its function in steering. Propulsion is by the excessively rapid motion of the pectorals which seem extremely small for the amount of work which they are called upon to do.

It is extraordinary that this use should not have developed larger fins.

As everyone knows, many of the tropical reef fish, especially sparoids and labroids, use their pectorals most actively in locomotion. The type of movement is, however, entirely different. It is the same in both of the families which I have mentioned, but is a slow, deliberate paddling, and nothing like the excessively rapid movement of the fins of these little reed fish which, at a distance, seem to have two tiny mechanical propellers on each side of the chin.

Erpetoichthys (*Calamoichthys*) *calabaricus* Smith is, of course, related to *Polypterus*. Doctor Jordan (Guide to the Study of Fishes, 1, 1905: 608), in his treatment of the Crossopterygii, shows that *Erpetoichthys* Smith must supplant *Calamoichthys* of the same author, who changed the earlier name in the erroneous belief that it was preoccupied by *Herpetichthys*, an eel, and by *Herpichthys*, a blenny. It is so much better known under the name of *Calamoichthys* that I have always called it by this name.—T. BARBOUR, *Museum of Comparative Zoology, Cambridge, Massachusetts.*

A RECORD TIGER SHARK FROM SOUTH CAROLINA.—Authentic records of large tiger sharks (*Galeocerdo arcticus*) appear to be rare or almost nonexistent. Jordan and Evermann state the species reaches a length of from 15 to 30 feet. Unfortunately they make no comment as to how they acquired their data as to the larger figure. Garman makes no comment as to its size. Radcliffe (Bull. U. S. Bureau of Fish., 34:263) tells of taking an unusually large female that was 12 feet in length.

In *The Fishes of Australia* (1940, Part 1) Whitley records a specimen, 15 feet 6 inches, taken at Maronba, New South Wales, by E. Roberts in 1936. He calls the specimen *G. rayneri* which Garman uses as a synonym of *G. arcticus*.

On July 18, 1940, a male specimen, 15 feet 2 inches long, was taken off the Pilot Boat which was anchored about 4 miles off the mouth of the Charleston Jetties. This shark was taken on a set shark line by Mr. John Gardner, an apprentice pilot, and was finally subdued after about an hour's terrific battle. A one-inch rope, the one used to haul up the yawl, was put around its tail and a block and tackle attached to the davit. Three men were unable to lift it. With the help of two more they were finally able to lift it clear of the water, expecting any moment that the rope would break or the davit give way. Another rope with block and tackle was then attached to its head and raised in a like manner. The shark was then laid along the gunwale of the pilot boat and measured with a yard stick by Mr. Gardner. I have personally known Mr. Gardner for over ten years and know that his veracity is unquestioned.

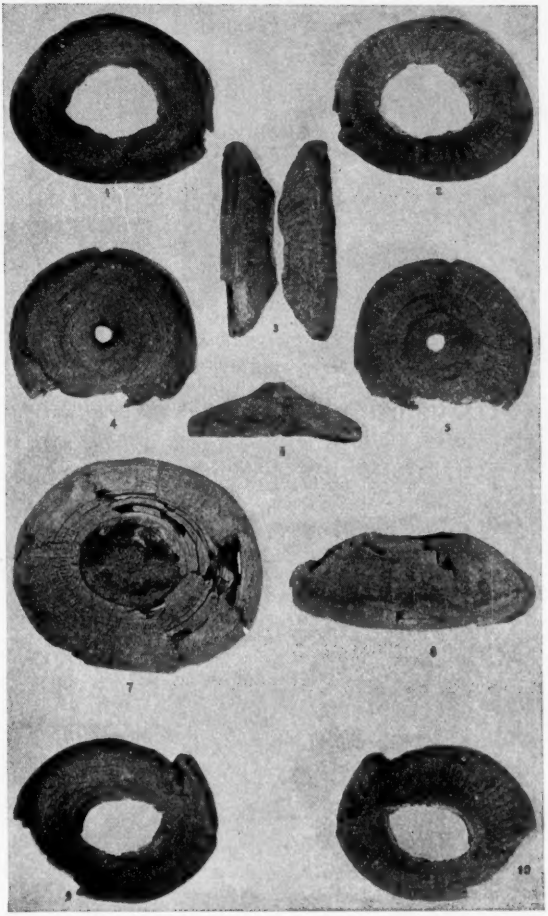
Photographs of the shark showing not only its size and markings but its jaws were taken by Mr. Gardner. From these photographs I identified it as a specimen of *G. arcticus*. One can clearly see the markings along its side as well as the shape of the teeth. However, for confirmation I sent the photographs to Stewart Springer, of the Bass Biological Laboratory, who concurred with my findings. Strangely enough Mr. Gardner did not think the shark of such an unusual size as to warrant particular attention. As far as I can ascertain, this appears to be the largest record for the Western Atlantic.—E. MILBY BURTON, *The Charleston Museum, Charleston, South Carolina.*

VERTEBRA OF *CARCHARODON MEGALODON*.—Some time ago the National Museum received a specimen collected by Dr. W. F. Foshag in Zone 12, near the end of the cliff south of Parker's Creek, Maryland, about 6 feet above tide level. This specimen had considerable superficial resemblance to the large west American limpet, *Lucapina crenulata*, and proved quite a puzzling thing.

Later, Dr. Arthur R. Barwick of the Catholic University, the junior author of this paper, brought three additional specimens to our Museum, collected by him at Wakefield, Nomini Cliff, on the west side of the Potomac River. Two of these were found in juxtaposition, giving a decided hint as to the true nature of the objects, which was strengthened by the finding, revealed by microscopic preparations, that they were fossilized cartilage. The two found in juxtaposition represent parts of what must have been a biconcave disk.

Passing in review the organisms that have been reported from the Calvert formation, we are lead to believe that these structures are the vertebra of the giant shark, *Carcharodon megalodon*, frequenting the seas of the region in question at that period. The gigantic teeth of this shark are not at all rare in this formation.

The objects may be described as key-hole limpet-shaped, which in juxtaposition furnish a deeply biconcave disk, with an oval perforation in the center. The concave portion is marked by a series of concentric lamellae; the convex portion has strong, fairly closely spaced, radiating ridges. This is the structure of three of the specimens; the fourth specimen is of almost circular outline, deeply concave and raised to a moderately elevated, regular cone on the convex side with a small, almost circular, perforation in the center.



Dr. Foshag's specimen, Cat. No. 16366, measures: Greater diameter, 95 mm.; lesser diameter, 80 mm.; elevation, 30 mm.; the paired specimens, Cat. No. 16365, measure: Greater diameter, 75 mm. each; lesser diameter, 61 and 60 mm., respectively; elevation, 21 mm. each. The circular specimen measures: Diameter, 68 mm.; elevation, 21.5 mm.—PAUL BARTSCH, *United States National Museum*, and ARTHUR R. BARWICK, *Catholic University, Washington, D. C.*

SUPPRESSION OF *LISSOCHILUS* IN FAVOR OF *ACROSSOCHEILUS* FOR A GENUS OF ASIATIC CYPRINID FISHES, WITH NOTES ON ITS CLASSIFICATION.—*Lissochilus* Weber and de Beaufort, 1916 (Fishes Indo-Australian Archipelago, 3: 167; genotype *Barbus dukai* Day by subsequent designation of Jordan, 1920), is preoccupied by *Lissochilus* (Pethö) Zittel, 1882, a fossil gastropod.[1] *Lissochilus* has been used, in a wider sense than that of Weber and de Beaufort, by Herre and Myers (Lingnan Sci. Journ., 1931, 10: 242), and by Myers (*Idem.*, 1931, 10: 257), for a group of Cyprinidae extending from Sumatra to Burma and northern China. Herre and Myers showed that two nominal genera, *Acrossocheilus* Oshima, 1919, and *Lissochilichthys* Oshima, 1920, cannot be separated from Weber and de Beaufort's genus. The first of these, *Acrossocheilus*, will now stand in place of *Lissochilus* as the name of the entire genus. The nominal forms which I now refer to *Acrossocheilus* are:

Barbus paradoxus Günther, Cat. Fishes Brit. Mus., 1868, 7: 97 (Formosa; two species possibly included; types in London).

Barbus dukai Day, Fishes of India, 1878–88: 564 (Darjeeling; type in Calcutta).

Crossochilus monticola Günther, Ann. Mag. Nat. Hist., 1888, (6) 1: 431 (Ichang, Yangtse River; types in London).

Crossochilus fasciatus Steindachner, Denkschr. Akad. Wiss. Wien, 1892, 59: 372 (Shanghai; types in Vienna).

Crossochilus styani Boulenger, Proc. Zool. Soc. London, 1901: 23 (Ningpo; types in London).

Gymnostomus barbatulus Pellegrin, Bull. Mus. Hist. Nat. Paris, 1908, 14: 263 (Lake Candidius, Formosa; type in Paris).

Gymnostomus kreyenbergii Regan, Ann. Mag. Nat. Hist., 1908, (8) 1: 109 (Nankancho, near Tinghsiang, North China; type in London).

Gymnostomus formosanus Regan, *Ibid.*, 1908, (8) 1: 149 (Lake Candidius, Formosa; type in London).

Gymnostomus labiatus Regan, *Ibid.*, 1908, (8) 2: 358 (Lake Candidius, Formosa; type in London).

Lissochilus sumatranus Weber and de Beaufort, Fishes Indo-Austr. Arch., 1916, 3: 169 (Bandar Baru, Sumatra; type in Amsterdam).

Acrossocheilus invirgatus Oshima, Proc. Acad. Nat. Sci. Philadelphia, 1920, 72: 123 (Buraku River, Formosa; type in Philadelphia).

Lissochilichthys matsudai Oshima, *Tom. cit.:* 124 (Kunanau River, Formosa; type in Philadelphia).

Barbus (*Lissochilichthys*) *hemispinus* Nichols, Amer. Mus. Novit., 1925, 185: 2 (Yenping, Fukien; type in New York).

Barbus paradoxus quinquefasciatus Koller, Ann. naturhist. Mus. Wien, 1927, 41: 34 (Wu Tschi Mts., Hainan; type in Vienna).

Barbus barbodon Nichols and Pope, Bull. Amer. Mus. Nat. Hist., 1927, 54: 345 (Nodoa, Hainan; type in New York).

Barbus lissochiloides Nichols, Bull. Amer. Mus. Nat. Hist., 1928, 58: 13 (to replace *Crossochilus fasciatus* Steindachner, preoccupied in *Barbus*).

Acrossochilus (*sic!*) *rabaudi* Tchang, Cyprinidae Yangtse, 1930: 76 (Chekiang; type in Paris).

Barbus hemispinus cinctus Lin, Carps of Kwangtung, 1931: 124 (Yaoshan, Kwangsi; type in Canton). See also Lingnan Sci. Journ., 1933, 12: 213.

Barbus (*Lissochilichthys*) *parallens* Nichols, Lingnan Sci. Journ., 1931, 10: 455 (Lung T'au Shan, Kwangtung; type in Canton).

Lissochilus smedleyi de Beaufort, Bull. Raffles Mus., Singapore, 1933, 8: 34 (Johore, Malay Peninsula; type in Singapore or Amsterdam).

Lissochilus thienemanni Ahl, Sitzb. Gesellsch. naturf. Freunde, 1933: 515 (Lake Toba, Sumatra; type in Berlin).

Lissochilus hutchinsoni Fowler, Proc. Acad. Nat. Sci. Philadelphia, 1934, 86: 120 (Nakon Sritamarat, Siam; type in Philadelphia).

Acrossocheilus wenchowensis Wang, Contrib. Biol. Lab. Sci. Soc. China, Zool. Ser., 1935, 11: 5 (Wenchow, Chekiang; type in Nanking).

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[1] I have not been able to check this edition of Zittel's *Handbuch*, but I have done so with at least one later edition, prior to 1916.

Lissochilus clivosius Lin, Lingnan Sci. Journ., 1935, 14: 307 (West Hill, Kweiping, Kwangsi; type in Canton).

Lissochilus tweediei Herre and Myers, Bull. Raffles Mus., Singapore, 1937, 13: 61 (River Yum, trib. to River Plus, Perak; types in Stanford).

Lissochilus hendersoni Herre, Bull. Raffles Mus., in press (types in Stanford).

The following species should be closely examined for their possible pertinence to *Acrossocheilus:*

Varicorhinus shansiensis Nichols, Amer. Mus. Novit., 1925, 182: 2 (Niangtzi-kwan, Shansi; type in New York).

Barbus rendahli Lin, Carps of Kwangtung, 1931: 122 (Shiu Kwan, Kwangtung; type in Canton). See also Lingnan Sci. Journ., 1933, 12: 210.

Poropuntius normani Smith, Proc. U. S. Nat. Mus., 1931, 79, 7: 14 (southeastern Siam; type in Washington).

Herre and Myers (Lingnan Sci. Journ., 1931, 10: 242) have pointed out the gradations of lower jaw structure that connect up the extremes within the genus. I wish again to repeat that the forms inhabiting China, Formosa, and Hainan (with the possible exception of *barbodon* and *hemispinus*) form a closely knit unit, more nearly related to each other than to any other group or species of barbine cyprinids. Such a relationship would never be suspected from the treatment accorded the species by almost all authors. The *fasciatus*-like forms, with a free sharp lower jaw, which fall within present-day loose definitions of *Varicorhinus*, *Scaphiodon* or *Gymnostomus*, are connected by intermediates with fishes like *labiatus*, which fit into similar loose definitions of *Barbus*. Nichols (Bull. Amer. Mus. Nat. Hist., 1928, 58: 13–22) places *A. kreyenbergii* next such a distantly related species as *Scaphesthes tamusuiensis* and separates these widely from *matsudai* and *fasciatus*, yet his arrangement was a considerable improvement on any classification of the Chinese cyprinids up to 1928. But in the plethora of Asiatic barbine genera and species, the wide though connected series of modifications of the lower jaw and lip make *Acrossocheilus* difficult to define. All of the Chinese *Acrossocheilus* are remarkably similar in everything except the lower jaw. The general configuration and proportions of the body and head, the pitted snout, the general features of squamation and fin positions, and especially the very distinctive color pattern (which seems to exist in two phases), all go to make up a group that is recognizable on sight and is certainly a phylogenetic unit.

Within the Chinese group, the species are in the utmost confusion. Six of the specific names are based on Formosan types and no author has considered all of these and attempted to straighten out the Formosan species. Nichols and others have shown that the Formosan fish fauna is practically identical with that of adjacent Fukien and most if not all Formosan fresh-water fishes are also found in China. Yet most of the many writers on Chinese fishes have not given proper attention to Formosan species, but have proceeded as if the fauna of the island had no bearing on the classification of Chinese fishes. Moreover, Chinese ichthyology is in an exceedingly confused state. Rendahl's excellent critical review of 1928 was based on scanty material and unfortunately was published simultaneously with Nichols' summing up of his large collections. The numerous subsequent papers by Chinese authors have, with a few brilliant exceptions, been of such unutterably poor quality as to confuse matters beyond all measure. The classification of *Acrossocheilus* has suffered accordingly, and it is impossible to determine with any exactness the status of most of the names applied, without a complete revision of the genus. Herre and Myers attempted some preliminary sorting based on mouth structure, but their conclusions in regard to specific synonymies are purely tentative. Myers (Lingnan Sci. Journ., 1931, 10: 257) has discussed other forms, and Chu (China Journ. Sci. Arts, 1931, 14: 187–191) discussed two nominal species. I believe that some of his supposed specific characters for *styani* are merely sexual. Lin (Lingnan Sci. Journ., 1933, 12: 209–215) has keyed out the South China species. Chu (Biol. Bull. St. John's Univ., Shanghai, 1935: 2) has also discussed the scales and teeth. But nowhere save in the list I have given above have all the nominal species been mentioned in the same paper, and I am not sure that I have not missed some.

Some authors prefer to place *Acrossocheilus* in the synonymy of *Barbus*. I am not particularly averse to this treatment, but I insist that it solves no difficulties. Taxonomy

is not nomenclature but phylogenetic arrangement, and at least the Chinese group of *Acrossocheilus* is a nice phylogenetic unit. Any system which sorts the species out into non-phylogenetic pigeonholes within the genus *Barbus* is just as artificial (and erroneous) as one which places the species into the strange assortment of genera under which they were originally described. In other words, in true taxonomy phylogenetic arrangement is everything and the nomenclature immaterial.

The more southerly Indian, Siamese, and Malayan species lack the characteristic color pattern of the Chinese ones, and have larger scales. I am not at all certain that they are as closely related to the Chinese forms as they seem to be. I suspect that they may actually be closer to other southern genera but conclusions in matters of this kind must await a much needed review of the cyprinid genera of Indo-China, Siam, and Burma. In any event, it would be premature to provide a new generic or subgeneric name (to replace *Lissochilus*) for these southern forms, when it may be discovered that some name, such as *Poropuntius*, may be already available.

Finally, it should be pointed out that *A. parallens*, from Lung T'au Shan, is probably identical with the specimens reported by Herre and Myers as *Lissochilus labiatus* from "Lung Fan Shan," which is a misspelling of the same locality. Under the International Rules, *fasciatus* is a dead homonym, and even if removed from *Barbus*, it cannot be resuscitated. Nichols' name *lissochiloides* replaces it.—GEORGE S. MYERS, *Natural History Museum, Stanford University, California.*

NOTE ON METHODS OF COLLECTING FISHES FROM A DIVING HELMET. —During the winter of 1940 the writer was engaged in studying and collecting the shore fishes of the West Coast of Mexico, and the methods described here were developed and used in the course of this work. They are a further development of techniques with diving apparatus described by me in COPEIA, 1938 (3): 128–131.

Electrically ignited dynamite caps have been used for years for collecting fishes and have been employed by divers. Such caps are somewhat troublesome to use, however, because it is necessary to have waterproof electrical connection to a source of electricity to fire them. Because of this and other difficulties, the fuse type cap was adopted. This cap, which has an unloaded 22 cartridge with primer intact sealed in the open end (where the fuse is inserted), has many advantages for use under water. The 22 cartridge serves to ignite the cap, and it in turn is ignited by percussion when clamped in a suitably designed holder mounted on the end of a pole. The holder, of course, is only in contact with the head of the 22 shell, never with the dynamite cap itself, and is built with a firing pin and trigger mechanism that can be set off from the opposite end of the pole. Such an apparatus proved to be as simple to load and fire under water as a single-shot rifle would be in the woods. It is quite effective against any small fishes within a foot or so of the cap. The only effect that the diver may notice is a sharp, unpleasant, tingling sensation as the cap explodes. Of course, this effect becomes less as the distance from the explosion increases. As a rule, however, caps were fired within 10 feet of the diver. It is decidedly not recommended that dynamite caps be employed by a diver wearing nothing but a face mask, or other gear that does not protect the head and especially the ears.

In quiet, open water, undisturbed by currents or heavy surge, fish poisons may be liberated on the bottom by a diver. Such poison is best carried below in solution in a rubber bag, for example a douche bag with hose and hose clamp, and can then be easily released under and about rocks and coral and forced into cracks and holes. This technique is most effective in capturing small reef dwelling fishes, which, when absent from tide pool fauna, are rather difficult to catch by other means. The diver must catch the stupefied and poisoned fishes as soon as the poison takes effect, for in most localities, the larger fishes will quickly devour any small fishes that are intoxicated and helpless if given a chance. The helpless fishes can be captured by a small net or with the hand, and can best be kept in a glass jar with an easily removable lid until the diver returns to the surface.—VERNON E. BROCK, *Department of Research, Fish Commission of Oregon, Astoria, Oregon.*

NOTES ON TWO FISHES, *OPHICHTHUS OCELLATUS* AND *PARANTHIAS FURCIFER*, TAKEN OFF PENSACOLA, FLORIDA.—

Ophichthus ocellatus (Le Sueur)

Muraenophis ocellatus Le Sueur, Journ. Acad. Nat. Sci. Phila., 5, 1825: 108, pl. 4, fig. 3.
Ophichthys guttifer Bean and Dresel, Proc. Biol. Soc. Wash., 2, 1885: 100.

While experimenting with trawl lines for catching red snappers in the Gulf of Mexico, in October, 1931, a set was made 38 miles off Penacola on the edge of the shelf in about 80 fathoms. Nearly every other hook caught a specimen of *Ophichthus ocellatus* and no other species of fish whatever. Fortunately a good series of speciemns was saved and from these it has been possible to show that *O.oc ellatus* and *O. guttifer* are synonymous.

These species are described as being closely related, the chief difference being in the origin of the dorsal with respect to the pectoral fin. In *ocellatus* the dorsal is said to begin over or just before the tip of the fin while in *guttifer* it originates behind, a distance equal to the diameter of the eye.

An examination of twenty-two specimens shows that the above character is of no specific value for no significant differences could be found between those fish with the dorsal origin forward of the pectoral tip and those with the origin behind. Of the twenty-two fish, seven had the dorsal origin in advance, three opposite, and twelve behind the tip of the pectoral. The distances in advance were: one fish, one-third an eye's diameter, four fish, one-half, and two fish a whole eye's diameter. The distances behind were: seven fish, one-half, and five fish a whole eye's diameter.

The following data were obtained:

	Dorsal origin before pectoral tip	Dorsal origin opposite pectoral tip	Dorsal origin behind pectoral tip
Number of fish	7	3	12
Males	0	2	4
Females	7	1	8
Total length (average)	579 mm.	577 mm.	653 mm.
Snout to anus[1]	47.3	46.2	46.6
Head[1]	12.9	12.2	12.4
Snout[2]	18.7	20.3	17.6
Eye[2]	11.4	11.6	11.6
Interorbital[2]	15.6	15.0	14.4
Pectoral length	35.2	35.8	32.0
Snout to dorsal origin[1]	16.7	16.8	17.3
Number of lateral spots	19–22	21[3]	19–21[4]

[1] Percentage in total length.
[2] Percentage in head.
[3] One fish.
[4] Six fish.

The length of the pectoral fin averaged 34.3 of the head for six males and 33.3 per cent for sixteen females. The males averaged 566 and the females 632 mm. in length. The smallest fish in the series measures 513 and the largest 873 mm.

Known from South Carolina to Brazil.

Paranthias furcifer (Cuvier and Valenciennes)

One specimen, 375 mm. in total length, was taken 25 miles off Pensacola, in 28 fathoms, October 19, 1931. This brings the range of this species well within the Gulf of Mexico. Known previously from Cuba to Brazil, and from Cape San Lucas to Peru.—WILLIAM C. SCHROEDER, *Museum of Comparative Zoology, Cambridge, Massachusetts.*

NOTES ON FOUR MALE SPECIMENS OF THE FRILLED SHARK (*CHLAMYDOSELACHUS ANGUINEUS*)[1].—The rarity of adult specimens of *Chlamydoselachus* preserved in American museums becomes apparent upon reading Gudger and Smith's splendid monograph (Am. Mus. Nat. Hist., Bashford Dean Mem., Art. V., 1933) dealing with the natural history of the frilled shark. In a table on page 259 Gudger and Smith list but eight adult specimens of this shark as being present in American museums. Of these eight adult specimens, seven are females and one is

[1] The writer wishes to thank Professor A. H. Wright for placing the Cornell specimen at his disposal; Dr. E. W. Gudger for allowing the writer to spend a day in his laboratory measuring the American Museum specimens; and Dr. Leonard P. Schultz for kindly loaning the single U.S. National Museum male specimen.

a male. To this list, therefore, it seems desirable to add data concerning three additional male specimens, one present in the Cornell University museum and two preserved in the collections of the American Museum of Natural History. For the sake of completeness measurements have also been made on the male specimen of *Chlamydoselachus* in the United States National Museum referred to by Gudger and Smith.

The Cornell specimen of *Chlamydoselachus* (no. 4647) came from Japan and was purchased from H. A. Ward, December 15, 1903, for $30.00 by the late Professor Burt G. Wilder. Upon arrival at Cornell it was transferred from formalin to alcohol and in this medium has remained up to the present. On March 13, 1905, Professor Wilder cut the head from the body and carefully removed the brain. His work on the brain of *Chlamydoselachus* was referred to in a paper (Science, N.S., XXI, 1905: 812–814) presented before the American Philosophical Society, April 14, 1905.

The two male specimens of *Chlamydoselachus* (nos. 13813) in the American Museum of Natural History were collected by Bashford Dean in 1901 from the Sagami Sea, Japan. After Dr. Bertram G. Smith's monograph (Am. Mus. Nat. Hist. Bashford Dean Mem., Art. VI, 1937) on the anatomy of the frilled shark was in page proof these sharks were found in a barrel of specimens that had probably not been opened for 20 years. For this reason they were not referred to in Dr. Smith's monograph. The specimens are undissected save for openings to allow the penetration of the preserving fluid and were kindly called to my attention by Dr. E. W. Gudger.

The male specimen of *Chlamydoselachus* (no. 48530) in the United States National Museum was procured from K. Mitsukuri of Japan and, according to Dr. L. P. Schultz, the name of the collector is unknown. It has been preserved in coiled condition and has a long mid-ventral incision.

In regard to the measurements which follow, it must be understood that all these specimens have stood in preservative for about a quarter of a century in a folded or coiled condition. Though every measurement was checked twice, the figures here presented undoubtedly only approximate the original condition.

MEASUREMENTS

Suggested by Gudger and Smith's monograph

	Specimens[2]			
	I	II	III	IV
Total length	1125 mm.	1175 mm.	1300 mm.	1345 mm.
From tip of snout to upper edge first gill-slit	90	127	128	133
From tip of snout to hind edge last gill-slit	175	204	189	204
From tip of snout to front edge dorsal fin	668	643	720	788
From tip of snout to front edge pelvic fins	560	550	596	624
From tip of snout to front edge anal fin	663	671	715	760
From tip of snout to front edge anus	636	637	683	731
Length of pectoral (midpoint of base to tip)	71	101	88	89
Length of right myxopterygium + pelvic fin	185	204	211	218
Length of left myxopterygium + pelvic fin	190	207	211	218
Length of base of anal	180	170	185	205
Distance front edge of anal fin to tip of tail	462	504	585	585
Distance hind edge of anus to tip of tail	479	524	607	610
Length of caudal fin	282	334	385	360
Maximum depth of caudal	88	101	95	108
Eye orbit, longitudinal	19	21	17	24
Eye orbit, vertical	14	11	9	14
Interorbital space	57	67	70	76
Maximum depth of body	125	120	138	150
Maximum girth of body	275	297	302	360
Length of mouth (from angle of mouth to tip of lower jaw)	82	93	95	97

[2] Specimen I—Cornell Specimen No. 4647. II—United States National Museum Specimen No. 48530. III—American Museum Specimen No. 13813. IV—American Museum Specimen No. 13813.
[3] Brain removed—measurement approximate.

In the above measurements the dorsal fin has been interpreted as beginning anteriorly with a median row of rather prominent scales. The mid-ventral fleshy keel extending anteriorly for a short distance from the base of the anal fin rays has been interpreted as part of the anal fin.

The writer suggests that similar information regarding unknown specimens of *Chlamydoselachus* in other museums and universities be noted for, as has been pointed out by Dr. Bertram G. Smith (*op. cit.*), there is still much room for morphological work on these rare sharks, especially the males.—PERRY W. GILBERT, *Department of Zoology, Cornell University, Ithaca, New York.*

Herpetological Notes

EGGS AND NESTS OF *HEMIDACTYLIUM SCUTATUM* IN THE ITHACA REGION.—Published accounts of the occurrence of the four-toed salamander, *Hemidactylium scutatum* (Schlegel), in the region of Ithaca, New York, have appeared in the papers of Reed and Wright (1909, Proc. Amer. Phil. Soc., 48: 402) and Bishop (1920, N.Y. State Mus. Bull., 219–220: 251–282). Basing his observations on twelve nests, Bishop placed the egg complement at forty to sixty with an average of fifty eggs per female. Subsequent to 1920 the zoological department at Cornell has every year recorded nests with averages below fifty.

The late Dr. F. N. Blanchard in the course of his extensive studies on *Hemidactylium* found that ovarian egg complements in 217 females placed the average much lower, at twenty-nine eggs per female. Further counts by Dr. Blanchard of total egg complements from fifty natural nests yielded an average of 31.1 eggs per nest or 27.8 per nest when nests with more than forty eggs were disregarded due to the fact that these latter nests were probably the products of more than one female. As a result Blanchard (1935, Papers Mich. Acad. Sci. Arts and Letts., 21: 567) wrote as follows: "Whether this is a real difference between the salamanders of the Ithaca and the Ann Arbor regions remains to be demonstrated by further data from the vicinity of Ithaca."

Between May 19 and June 2, 1939, the writer located and obtained data on thirty-two nests in a swamp of about two acres at Ringwood, some 6 miles from the Cornell Campus. In every case a female was found guarding the nest, though the majority of the eggs showed an advanced stage of development. The number of eggs to a nest ranged from twelve to sixty-five. Only two nests with more than forty eggs were found; these, with forty-four and sixty-eight eggs, respectively, were probably the product of four females. Two nests were only 1 inch apart, a female guarding each nest. Three, 1 to 2 inches apart, were found also with a female guarding each nest. Adding the eggs in all nests (including the nests with forty-four and sixty-eight eggs) we arrive at a total of 781 eggs for thirty-two females or an average of 24.4 eggs per female. This figure compares more closely than do Bishop's with the Ann Arbor figure and it may be concluded from these observations that there is no essential difference between the Ann Arbor and Ithaca figures which the normal range of variation in this species could not explain.

Total length measurements on twenty-seven of the thirty-two nesting females were taken and a variation of 51.5 mm. to 72.5 mm. was found. No significant correlation between the length of the female and her number of eggs could be made. This is probably due to the relatively small number of nests observed, for Blanchard (*loc. cit.*) has shown with more extensive data that in general the larger females tend to lay more eggs.

The swamp in which the above mentioned nests were located contained an abundance of large fallen and rotting logs. Most of these logs were covered with a thick layer of spongy mosses of the genera *Thuidium, Mnium, Sphagnum,* and *Climacium.* Denser mosses at the base of tree stumps and about hummocks seemed less desirable for nesting as evidenced by the fact that twenty-seven of the thirty-two nests were found in the loose moss along logs. The fact that *Sphagnum* was not common in this region seemed to play no rôle in inhibiting the nest numbers. Of the thirty-two nests found only five were covered by *Sphagnum* while the remaining twenty-seven were covered by loose, fluffy mosses such as *Climacium, Thuidium,* and *Mnium.* The nests observed were covered by ¾ to 2½ inches of loose moss and were within 3 to 6 inches of water even though the water level had gone down somewhat in the swamp since the time of egg deposition. Logs covered by loose moss in areas where the water had completely dried up yielded no nests.

The writer wishes to thank Prof. A. H. Wright for many helpful suggestions and Dr. W. C. Senning for his generous aid in the field.—PERRY W. GILBERT, *Cornell University, Ithaca, New York.*

LONGEVITY OF THE RED-LEGGED FROG.—During the last two years there have died in the Museum vivarium two red-legged frogs, *Rana aurora aurora* Baird and Girard, under circumstances that make it possible to state with fair exactness their life span.

On May 9, 1927, two small red-legged frogs were captured alive and brought to the Museum by G. A. Hardy, who established them in a small vivarium. At the time of their capture they were either one or two years old.

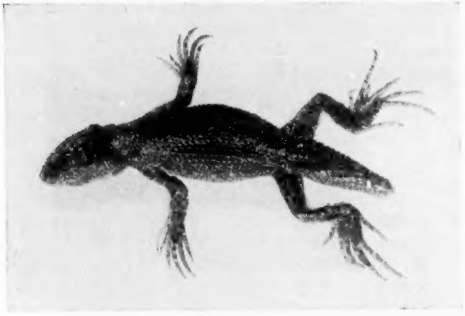
They fed well on a mixed diet of insects and earthworms and were both in good health until July, 1938. One of them stopped feeding early in June of that year and died on July 3, 1938, at which time it had been in captivity for eleven years and was probably twelve or thirteen years of age. At the time of death this specimen (a female) measured as follows (in mm.): snout to anus, 72; width of head, 27; diameter of eye, 8; diameter of tympanum (vertical), 5; interorbital width, 5.5; snout to orbit, 11; nostril to orbit, 4.5; fore limb from axilla, 41; hind limb from anus, 106; length of foot, 52; length of tibia, 35.

The other specimen developed cataract of both eyes in the summer of 1938. Both eyes slowly became opaque, the cornea became milky white, and later developed aggregations of black pigment granules similar to those of the skin. Though blind the frog readily took worms and insects offered to it on forceps though it seemingly did not detect the presence of food until it was within an inch or so of its nose.

After several months of such feeding it developed an association reflex between the noise of removing the top of the cage and snapping at the food. It would begin snapping whenever the cage was opened.

In May, 1940, the frog was weakening noticeably, could no longer elevate itself on its legs, and moved very little. In June it became necessary to place food in its mouth before it would feed. This frog died July 9, 1940, at the venerable age of approximately fifteen years, thirteen of which were passed in captivity. Measurements of this specimen, also a female, are as follows: snout to anus, 77; width of head, 29; diameter of eye, 8; diameter of tympanum (vertical), 6.5; interorbital width, 6.5; snout to orbit, 13; nostril to orbit, 5; fore limb from axilla, 46; hind limb from anus, 123; length of foot, 57; length of tibia, 41.—IAN MCTAGGART COWAN, *Provincial Museum, Victoria, B.C.*

A POLYDACTYLOUS LIZARD.—In the fall of 1938 a yellow-banded swift, *Sceloporus consobrinus consobrinus* (Baird and Girard), was collected during a field trip to the sand hills 12 miles east of Sterling, Rice County, Kansas, which had supernumerary digits. The specimen measured 40 mm. in body length, and the tail, which had begun to regenerate after nearly complete loss, measured 12 mm. in length.



Polydactylous lizard (*Sceloporus c. consobrinus*) from Sterling, Kansas.

The polydactylism was symmetrical. Both of the hands had six fingers, while on the feet eight digits were present. The extra finger on the hand was located between the

first and second digits. It was shorter than the other digits, but an X-ray picture revealed a metacarpal of full length. The number of phalanges in this extra finger could not be ascertained. In both of the hind feet a group of three additional toes was placed between digits I and II. The outer one of these extra toes was as long as either digit III or IV, while the other two were shorter. The metatarsals were all well developed. The fingers and toes all had normal claws.

Supernumerary digits are not uncommon in man, and have been observed in a number of other mammals, such as horses, dogs, cats, pigs, mice and guinea pigs. They have also been recorded from fowls and from some amphibians. Recent literature seems to contain no reference to polydactylism in reptiles. It is apparently rare in lizards.—S. L. LOEWEN, *Sterling College, Sterling, Kansas.*

NOTES ON THE MUD SNAKE IN FLORIDA.—During the summer of 1935 the writer had the opportunity to collect in the neighborhood of Gainesville, Florida. Returning one afternoon from an excessively hot and fruitless day's trip, he was met with the information that there was a large diamond-backed rattlesnake in an abandoned graveyard about 3 miles north of Arrondondo, Alachua County. Investigation disclosed no rattler, but instead a 6 foot specimen of the mud snake *Farancia a. abacura*, coiled in a hole in one of the mounds. When she was removed the excavation proved to be a shallow affair, 10 to 12 cm. deep, 20 long, and 7 or 8 wide. As we were about to leave, several rounded objects were noticed in the walls, and upon closer examination they were seen to be eggs. Forty were found.

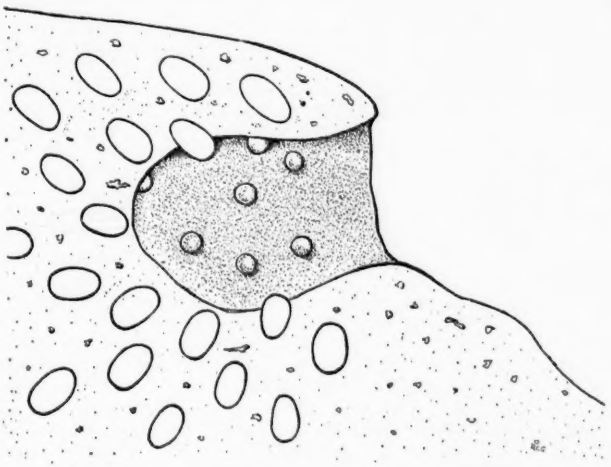


Figure 1.—Diagrammatic cross section of the burrow of *Farancia*, showing distribution of the eggs in the soil.

The eggs were imbedded in the walls of the cavity in three layers. Two of these were completely buried, while the outermost jutted slightly from the earth. The diagram will show more clearly the manner in which they were placed. How the female accomplished this feat of multiple burial it is difficult to guess. One possibility is that the eggs were laid in three layers, and that subsequent movements of the adult caused earth to seep in around them. This is not probable, however, due to the tightness with which the earth was packed, and the large spaces between the eggs.

They were taken home, examined, and measured. They were creamy-white prolate spheroids, parchment-like in texture, averaging 25 x 35 mm. No indications of the small

rod-like brown flecks noted by Meade (COPEIA, 1937: 12) were seen, but our eggs were somewhat stained by the soil, so these flecks may not have been noticed. Twenty were given to one member of the group that accompanied the writer on the trip, the others were kept. They were buried in an incubating medium made by mixing the sandy soil of the graveyard with sphagnum moss, and heating the mixture until all undesirable life in it had been eliminated. From the twenty eggs that were kept a series of embryos was taken by opening them at more or less regular intervals. These were preserved for comparison and further study. Those that were unopened hatched, with the exception of five which seemed infertile.

The first egg, opened the day after they were collected (August 21), contained a well developed embryo. The body scutellation was complete and the tail spine was completely formed, but the plates of the head were lacking. The animal did not possess that appearance of a coiled watch hairspring common to the early developmental stages of most snakes; the head was quite large, and the body translucent. The pulse was definite and rapid (62) and feeble voluntary movements were observed in response to pricking and to the sudden switching on of light. The pattern, although pale, was definite and even showed some trace of the pink that was to come.

This indicated either that the eggs were well-developed at the time of oviposition and that they were laid but shortly before, or as I believe, that the female had stayed with them for some time. Mr. Meade, in the article previously referred to, states that a female *Farancia,* having just laid a cluster of eggs in captivity, apparently attempted to coil around them, either for ". . . the purpose of incubating them or merely to hold them in a close group." Since in the wild state they were laid in the earth, there could have been no need to hold them together. A shed skin, evidently of *Farancia,* and probably from our female specimen, was found 5 or 6 feet from the hole, on a stone fence, indicating that she might have been at or near the nesting site for some time.

Of the eggs that were given to the friend little is known, save that they hatched during the first days of October. Of those retained, successive eggs were opened August 21, September 1, 11, 19, and 28, and October 1. The eggs showed a progressive increase in size, 25 x 35 mm. August 21 and September 1, to 30 x 45 mm. October 5. Response to touch from a pithing needle, and to the sudden switching on of a strong light in a previously darkened room, increased rapidly in amplitude. Tongue movements were not observed until September 28. The length of the August 21 embryo was 127 mm., and that of October 5, 203 mm. The pulse rate was 62 in the August 21 embryo, 37 in the September 1 specimen, 31 on September 11, and 48 on September 19. In later embryos the heart cannot be detected through the opaque body. In the earliest embryo the scales of the body are formed, but those of the head are not; the head was completely covered with plates by September 11. The coloration is gray on almost imperceptible pink in the earliest embryo, darkening in the later stages to black and red.

The first young snake cut its egg on the morning of October 6. It stayed inside occasionally protruding its head, but withdrawing it at the slightest disturbance. At 6 P.M. on the following day it came out and immediately burrowed into the earth-sphagnum medium in which the egg lay. The others left the eggs between 7:30 P.M. and 8:00 the next morning. The red bands did not entirely surround the body, nor were there any traces of red in the centers of the black blotches. The young snakes measured 215 mm., 230 mm., 182 mm., 234 mm., 204 mm., 207 mm., 191 mm., 217 mm., and 208 mm., in length, averaging 209.7 mm. When they were five days old their skins became quite cloudy, and they finally moulted on the eighth day. Two days later all but one were given away, after two had taken small earthworms and the rest refused them. The remaining one lived until April 26, 1936. During its captivity it ate seventeen small earthworms, five *Desmognathus fuscus,* one small *Triturus viridescens,* and one *Eurycea bislineata.* It moulted on October 16, February 4, and March 17. By the time it died (during an epidemic of mites in the writer's cages) it had grown from 215 mm. to 354 mm. in length, and the adult pattern was almost completely developed, save for the fact that the red bands still extended one-third of the way up the sides.

Thanks are due Dr. A. H. Wright and Mr. Robert McCauley, Jr., of Cornell University, for aid in the preparation of these notes for publication.—ROBERT C. GOLDSTEIN, *Department of Zoology, Cornell University, Ithaca, New York.*

THE RED-TAILED SKINK, *EUMECES EGREGIUS*, IN ALABAMA.—The two species of red-tailed skink, *E. egregius* and *E. onocrepis*, have not been known outside of peninsular Florida and extreme southeastern Georgia. A specimen of *Eumeces egregius* was collected in Alabama, in Gulf State Park near Gulf Shores, Baldwin County, on March 16, 1940. The day was overcast and cool, the temperature 70° F. The specimen was found lying under dry wood debris in country predominantly pine and scrub palmetto. The total length of this specimen, a male, is 123 mm., 77 mm. of which is tail. The tail is perfect and unregenerated, although broken off by the lizard itself in the container after capture. The specimen has been deposited in the collection of the Chicago Academy of Sciences.

This example does not agree entirely with the usual scutellation of *egregius* as defined by Taylor (1936, Kansas Univ. Sci. Bull., 23: 490) but falls well within the limit of variation as shown by him. It differs from more typical specimens in these characters: the frontonasal forming no suture with the frontal, the prefrontals being broadly in contact; prefrontals also in contact with the first supraocular on both sides, excluding the frontal from the first superciliary; only one large presubocular instead of two small ones; three supralabials precede the large subocular instead of four; six supralabials altogether instead of seven.—CARL F. KAUFFELD, *Staten Island Zoological Society, Staten Island, New York.*

NEW RECORDS OF FROGS AND TOADS FOR OKLAHOMA.[1]—During the past four years, but especially during the spring and summer of 1939, night collecting trips to various parts of Oklahoma have been undertaken for the purpose of tracing the distribution of toads (*Bufo*) in the state. Other frogs and toads were collected whenever opportunity offered. Several hundred specimens have now accumulated, most of which have been deposited in the University of Oklahoma Museum of Zoology, although a few have been retained in the private collection of the author. It is upon these collections that the following annotated list is based. Only those specimens are included in this report which are believed to be new county or state records.

Acris crepitans Baird.—Specimens have been taken in Kiowa, Woods, and McClain counties. Calls of this species have been heard in the following: Canadian, Cotton, Creek, Garvin, Jackson, Logan, and Tillman counties. It is probably statewide in distribution in the habitat afforded by the margins of lakes, streams, cattle-tanks, and buffalo-wallows, in all of which, except the last, it is known to breed.

Bufo americanus americanus Holbrook.—Collected in Bryan and Pottawatomie counties; the distinctive call heard in extreme eastern Kay and in southern Ottawa counties. It is generally distributed in the wooded and savannah areas of eastern Oklahoma.

Bufo cognatus Say.—Collected in Blaine, Canadian, Cotton, Garvin, Jackson, Kay, McClain, Oklahoma, Osage, Stephens, Tillman, and Washita counties. This toad is distributed in grassland only. The most eastern record is a single specimen from Burbank, western Osage County, in the ecotone between the mixed-grass and tall-grass prairies.

Bufo compactilis Wiegmann.—This species has been recorded only recently from Oklahoma (Bragg, A. N. and Robert Kuntz, 1940, Proc. Okla. Acad. Sci. 20, in press) from southern Comanche County. Subsequently, it has been found to be very abundant in the short-grass area in southwestern Oklahoma. It was breeding in large congresses throughout this region on the nights of August 8 and 9, 1939, after a heavy rain. Specimens are on hand from the following counties: Cotton, Custer, Jackson, Jefferson, Harmon, Kiowa, Tillman, Stephens, and Washita.

Bufo insidior Girard.—The little green toad, although common in Texas and known from Kansas, has apparently not been recorded previously from Oklahoma. Dr. Charles C. Smith and I found it to be fairly common in the southwestern part of Oklahoma where it was breeding with *B. compactilis* (see above). Whereas *B. compactilis* was also found in great numbers on roadways, *B. insidior* was seen only in breeding-pools. We collected specimens in Cotton, Jackson, southern Kiowa, and Tillman counties. In addition, Mr. Kuntz has furnished one specimen taken on a street during an evening shower in

[1] Contributions from the Zoological Laboratory of the University of Oklahoma, No. 219. Aided by a grant from the Faculty Research Fund.

Lawton, Comanche County; and the University of Oklahoma Museum of Zoology has a single specimen from extreme northern Garvin County.

Bufo w. woodhousii Girard.—This toad is very common in all parts of Oklahoma except the eastern third. It is common under streetlights and in wooded bottomlands along streams and on sandy floodplains of the larger rivers. Specimens which appear to furnish new county records are on hand from Blaine, Canadian, Cotton, Cherokee, Craig, Creek, Grady, Jefferson, Kay, Kingfisher, Kiowa, Logan, Love, Muskogee, Okfuskee, Osage, Seminole, Stephens, and Wagoner counties.

Hyla versicolor versicolor Le Conte.—A smooth-skinned hyla of this species is common in the oak-hickory savannah of central and eastern Oklahoma. It has recently been reported from Cleveland and Pottawatomie counties (Bragg, A. N. 1940, Amer. Midl. Nat., in press), and evidence is there given for considering it the typical subspecies rather than as *H. v. chrysoscelis* (Cope). A calling specimen was taken in southwestern Cherokee County near the Muskogee County line after a violent storm in August, 1939. Numerous others were heard calling all the way from here to central Muskogee County during the same night.

Microhyla olivacea (Hallowell).—The Texas narrow-mouthed toad is common and numerous in all parts of Oklahoma. It is especially abundant in the prairies and in the oak-hickory savannah areas. It has been collected while breeding in the following counties: Kiowa, Osage, and Pottawatomie. Tadpoles have been found in central Greer County. Unmistakable breeding calls have been heard (usually in several localities) in Canadian, Carter, Cherokee, Comanche, Cotton, Creek, Jackson, Lincoln, Muskogee, Oklahoma, and Tillman counties.

Pseudacris nigrita clarkii Baird.—The general confusion in the status of members of the genus *Pseudacris* makes specific records somewhat doubtful. Specimens which are much spotted and not striped have been taken in Comanche and Kiowa counties. Others whose call was indistinguishable from that of these specimens and of others referred to this species from Cleveland County (Bragg, A. N., 1940, Amer. Midl. Nat., in press) have been heard in Canadian, Carter, Cotton, Oklahoma, Osage, Pottawatomie, McClain, and Tillman counties. A single specimen with three long stripes down its back and no significant spotting was taken in Comanche County.

Rana catesbeiana Shaw.—Bullfrogs have been collected in Caddo, Jackson, and Logan counties, all of them on roads at night. One was heard calling in mid forenoon in Greer County and another at night after rain in southwestern Cherokee County.

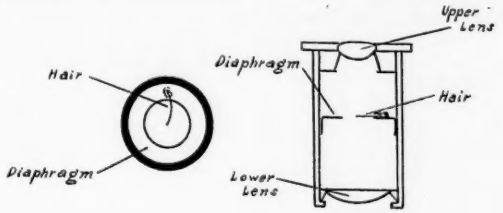
Rana sphenocephala Cope.—Grass-frogs are very numerous throughout Oklahoma, about water-holes and streams of all sorts. Most of those which I have seen tend to have the long and narrow head characteristic of *R. sphenocephala*. Such specimens have been collected in the following counties: Caddo, Cotton, Garfield, Grady, Grant, Greer, Jackson, Kiowa, Logan, Love, Mayes, Muskogee, Oklahoma, Pottawatomie, and Tillman.

Scaphiopus bombifrons Cope.—This spadefoot is abundant in central Oklahoma. It has been taken from roadways at night in Canadian, Kay, McClain, and southern Kiowa counties and has been found breeding in Comanche, Greer, and Kiowa counties. It is of interest that it was not found in southwestern Oklahoma on the nights of August 8 and 9, 1939, when so many other species, including *S. couchii*, were breeding.

Scaphiopus couchii Baird.—I have seen no previous published record of Couch's spadefoot from Oklahoma. It was found very abundantly throughout the southwestern region, breeding with several other species and also hopping in roads. Specimens were collected in Comanche, Jackson and Kiowa counties while breeding and newly hatched tadpoles were taken in central Greer County which, reared through metamorphosis in the laboratory, proved to be of this species. In addition, specimens were found at night on roads in Custer and Washita counties.—ARTHUR N. BRAGG, *Zoology Department, University of Oklahoma, Norman, Oklahoma.*

A TECHNIQUE FOR COUNTING THE SCALES OF SMALL SNAKES AND LIZARDS.—In the either very young, or extremely small specimens of snakes, or certain species of lizards, it is impossible to count the scales with the naked eye. The scales can be magnified with the hand lens or microscope, but in counting a long series, as for instance the ventrals in young snakes, or worm snakes, a blink of the eye may cause one to lose count. Then the work has to be done over again. Pins are used in snake counting with fairly accurate results on large specimens, but on very small specimens a binocular microscope must be used, and the pin becomes a clumsy tool under these conditions.

The method proposed here simplifies the counting of scales on small specimens of both snakes and lizards, reduces eye strain, and is more accurate for small specimens. When the upper lens of the eye piece of the microscope is removed, a diaphragm is exposed midway between the upper and the lower lenses (Fig. b). A small hair from the back of the hand, set in a spot of glue placed on the diaphragm so that the hair extends approximately half-way across the aperture (Fig. a), serves as a pointer when the eyepiece is reassembled and in place.



It is advisable to pin the specimen on some sort of movable platform, say a piece of corrugated board cut in the form of a rough crescent.—EDWARD C. TOBIASZ, *Field Museum of Natural History, Chicago, Illinois.*

THE FOUR-TOED SALAMANDER IN KENTUCKY.—On April 27, 1939, while collecting amphibians and reptiles in the vicinity of Cascade Caves, Carter County, Kentucky, I secured a specimen of the four-toed salamander, *Hemidactylium scutatum* Schlegel. This is, so far as I know, the first record for this species in the state.

Cascade Caves is a group of well-known caverns situated in northeastern Kentucky near Grayson and about 2 miles north of U.S. Route 60. It is known to herpetologists as the type locality of *Gyrinophilus porphyriticus duryi.* Dury (1933, Baker-Hunt Foundation Mus., Bull. 1: 1–22) lists thirteen species of amphibians and reptiles from this locality.

The limestone formations in the vicinity of the caves are interesting and bear such names as Prisoner's Wall, Rainbow Rock and Lover's Leap. These three formations are located about one-half mile from the entrance to the caves. Rainbow Rock, a portion of Prisoner's Wall, gets its name from the rainbow hues of the cliff that rises abruptly to a height of 40 feet and encircles a portion of the mountain side. Its face is wet by the continuous drip of a small stream that falls to a rocky gorge at the base. The salamander was found on a ledge of clay 5 feet above the floor of the gorge.

The specimen lay coiled in a nest that was covered by a mat of moss kept wet by the continual drip of water from the face of the cliff above. The nest contained twelve eggs which appeared to have been laid about two weeks earlier. Development of the embryos seemed to have ceased and they were decomposing. The salamander is a female with head-body length of 41 mm, and a tail length of 49 mm. The specimen has been deposited in the collections of the Cincinnati Society of Natural History.

The only other amphibians secured in the immediate vicinity were large specimens of *Desmognathus fuscus fuscus* and one *Eurycea longicauda longicauda.* A juvenile *Rana clamitans* escaped. Specimens of *Lampropeltis getulus nigra, Sceloporus undulatus undulatus* and *Coluber constrictor constrictor* were taken on the hillside above.—N. BAYARD GREEN, *Marshall College, Huntington, West Virginia.*

COPULATION IN GOPHER SNAKES.—Observation of two male gopher snakes (*Pituophis c. deserticola*) competing for copulation with a single female is reported by members of a field party visiting Stansbury, erstwhile island of Great Salt Lake, now connected with the mainland. They brought back photographs to corrobrate their report and sufficient to identify the snakes, the sexes of which were determined by Mr. Morris Barrie, a Navajo Indian member of the party, who claimed to be familiar with them.

According to Miss M. Barrie Berryman and Miss Lucile Olson, the snakes were first observed about 7:30 P.M. on May 30, 1940, in active combat, partly hanging over a small ledge, the female passive but the males bowing their necks and repeatedly striking at each other. While Miss Berryman ran back for her camera, the snakes fell to the rocks below, but their fall had little effect on their behavior.

The posterior parts of the bodies were closely entwined like the strands of a rope, as if for copulation, but the anterior parts were free. During the quarter or half hour of watching, the larger of the two males, about 5½ feet long, appeared to be gradually constricting and crowding the smaller male out from his entwined position. The reaction of the smaller male to this crowding was to strike at the other's head, which recoiled when hit and immediately prepared a return strike. The female was entirely passive, evincing no interest or choice between the combatants, which occasionally rested between struggles.

The snakes paid no attention when approached within 4 feet with the camera to take the picture; in fact they went on without showing concern of the human spectators until Mr. Barrie reached down and picked up the larger of the two males. In doing so the snakes became unwrapped and the female quickly disappeared under a large rock, followed by the smaller male.

Whether or not copulation actually took place seems not to have been determined, but probably not, because of the interruption. The incident, however, seems to have significance by adding to the growing chain of evidence in connection with at least two important ideas.

First, it indicates that gopher snakes are promiscuous; that they are probably not divided up in monogamous pairs during the mating season; that there is not necessarily a monogamous mutual attraction between the sexes; that the female is primarily passively tolerant and the males are aggressive. Second, it indicates that copulation takes place after the snakes have left their winter dens (April in this locality) and that breeding activities play no part in den life.—A. M. WOODBURY, *University of Utah, Salt Lake City, Utah.*

NEW LOCALITY FOR *SCELOPORUS UNDULATUS UNDULATUS*.—The range of the eastern fence lizard, *Sceloporus undulatus undulatus* (Latreille), is from southeasterly New York state to Florida. It is commonly found in the Pine Barrens of southern New Jersey, but in the extreme northern portion of its range, in the vicinity of the Hudson River Valley, it is considered rare.

The presence of *Sceloporus u. undulatus* in New York was rediscovered by Hassler (COPEIA, 163, 1927: 48–50). While visiting the Bear Mountain Trailside Museum, Bear Mountain, New York, September 7, 1939, the writer was informed by Mr. William H. Carr, Director of the Museum, that seven *S. u. undulatus* had been collected by Mr. Schwarting in what is believed to be a new locality. On July 14, 1939, Schwarting ascended Anthony's Nose, which is situated one-fourth of a mile south of the Putnam-Westchester County line, rising directly above the Hudson. This location is about 14 miles south of Breakneck Ridge where Hassler collected *S. u. undulatus* in 1926. Schwarting found his specimens at the very summit of Anthony's Nose, 900 feet altitude. It is interesting to note that both Hassler's and Schwarting's swifts were taken at a considerable altitude.

All Schwarting's specimens are adults. One male measuring 156 mm. was presented to the Peabody Museum at Yale University.—MARSHALL B. BISHOP, *Peabody Museum of Natural History, New Haven, Connecticut.*

DIADOPHIS PUNCTATUS IN MARYLAND.—As the geographic ranges of the subspecies of *Diadophis punctatus* are now understood, Maryland lies entirely within the distribution of the northeastern form, *Diadophis punctatus edwardsii*. In the course of a study of Maryland reptiles, specimens of *Diadophis* have come to hand from the eastern shore of that state which cannot be assigned to that subspecies, but are identifiable only as *Diadophis punctatus punctatus* or as intermediates between the two forms.

In the fourth edition of their check list, Stejneger and Barbour (1939: 99) note the range of *Diadophis punctatus punctatus* as "Southeastern states northward to northern North Carolina . . ." although Trapido (1937, The Snakes of New Jersey: 14) records a specimen from Lakewood, New Jersey. At least three specimens of this subspecies have been collected in Maryland. The first, a newly hatched juvenile, was collected by myself September 16, 1936, in the Pocomoke State Forest in Worcester County. The second, an adult female, was found among local material in the Berlin High School at Berlin, Worcester County, and was very kindly turned over to me by the biology teacher, Mrs. William Farlow. These specimens are Nos. S132 and S316 in my collection. A third specimen, an adult female, No. 75262 in the United States National Museum, also came from the Berlin High School.

All three of these specimens may be considered typical *D. p. punctatus*. In each, the neck ring is divided medially and the belly is heavily marked by a single row of black semi-circles. The sum of ventral and subcaudal plates is 188, 187, and 187 in the three specimens, in the order mentioned above. Blanchard (1925, Pap. Michigan Acad. Sci. Arts and Letters, 4, Pt. 2: 34) sets 191 as the usual maximum limit for this subspecies.

Other specimens from the eastern shore of Maryland are less typical in markings, commonly having the neck ring only narrowed medially, or with less definite ventral markings. However, the sum of ventral and subcaudal scales is low in each specimen.

Two of these individuals have been taken from the Pocomoke State Forest in addition to the typical specimen mentioned above. The first of these has a sum of 188 ventral and subcaudal plates; the row of semi-circular dots on the belly is occasionally interrupted, and the neck ring is one scale wide mid-dorsally. The ventral number of the second is 179; is has very heavy semi-circular dots and the neck ring is ⅔ of a scale wide mid-dorsally. Another specimen from Queen Anne's County, near Centerville, has a sum of 181 ventral and subcaudal scutes; the belly is strongly and regularly spotted and the neck ring is one scale wide. A fourth is from Old Furnace, near Snow Hill in Worcester County. It has a ventral number of 191, fourteen very faint dots on the belly, and the neck ring is only half a scale wide mid-dorsally. In these four specimens the intensity of the ventral markings becomes greater as the sum of ventral and subcaudal scutes becomes less.

In addition to the above, two eastern shore specimens exist which are nearer *D. p. edwardsii*, but which show definite tendencies toward *D. p. punctatus*. The first is from near Bishopville along the St. Martin's River, in Worcester County. It has a ventral number of 198, weak, scattered median dots on the belly, and a neck ring only half a scale wide mid-dorsally. The second specimen is from near Centerville with a ventral number of 197; the belly is marked only with small scattered dots, and the neck ring is only half a scale wide mid-dorsally. Here again with an increase in the sum of ventral and subcaudal scutes the ventral spots become reduced. In the material at hand the tendency of the neck ring to narrow does not seem to be correlated with reduction in ventral spots or scutes.

Specimens examined from Cecil County (Elk Neck) and other parts of Maryland have invariably proved to be typical *D. p. edwardsii*. *Diadophis p. punctatus* should be expected in southern Maryland, particularly along the bay strip as far north as Anne Arundel County.

On the eastern shore of Maryland specimens of *Diadophis* are invariably encountered in relatively damp situations. They are found in rotting logs and beneath loose bark along the edges of the extensive cypress swamps in the southern parts of the eastern shore, and in wooded areas under the litter of bark and leaves around the bases of dead trees and stumps.—ROBERT H. MCCAULEY, JR., *Department of Zoology, Cornell University, Ithaca, New York.*

NOTES ON PINE SNAKES FROM GEORGIA AND SOUTH CAROLINA.—The eastern pine snake, *Pituophis melanoleucus melanoleucus* (Daudin), ranges southward as far as the Carolinas; the related *P. m. mugitus* seems to be confined to Florida. It is therefore of interest to record the date for several pine snakes from the middle Savannah Valley of the Georgia-South Carolina border—an area on the southern border of the range of *P. m. melanoleucus*.

A specimen collected at DeBruce, Richmond County, Georgia, on August 30, 1937, shows the following characteristics. Number of scale rows 29-31-23. The sum of ventrals and subcaudals is 275. It will be observed that this scutellation lies between the respective limits of *melanoleucus* and *mugitus*, according to Barbour's original definition of the Florida form (1921, Proc. New England Zool. Club, 7: 117). In coloration, the specimen closely resembles many Florida individuals in being suffused anteriorly with reddish-brown, and in being posteriorly marked with brownish blotches on a straw-colored ground. The head is unmarked, and there are no lateral or ventro-lateral markings. This snake, a female, measures 4 feet 9 inches in length.

Another female, slightly smaller, taken on August 14, 1939, at North Augusta, Aiken County, South Carolina, shows quite different characteristics. The scale rows number 29-31-23. The sum of ventrals and subcaudals is 281. This is definitely a *mugitus* scutellation. In coloration this snake is unusual, being marked with very irregular, often confluent, spots of a pale orange shade, on a bright yellow ground. Anteriorly, there is some yellowish- brown suffusion. Lateral and ventro-lateral blotches are present, and the head is profusely maculated with black.

Two specimens, a male and a female, were taken during the summer of 1938 at a spot about 8 miles southwest of Augusta, Richmond County, Georgia. The male, 30 inches in length, has scale rows 29-31-22 (the even count anterior to the vent is due to the loss of the third row on the left side). Ventrals and subcaudals total 282. The coloration is that of *m. melanoleucus*: a whitish ground with black blotches becoming crowded and indistinguishable on the neck. Lateral and ventro-lateral spots are present, but the head is unmarked. The female, a large snake measuring 6 feet 2 inches, has scale rows 29-31-23. Ventrals and subcaudals total 277. This scutellation, also, is between that of *melanoleucus* and that of *mugitus*. The markings are similar in all respects to those of typical *m. melanoleucus*.

I have observed 2 other pine snakes, one from Aiken County, South Carolina, and one from Richmond County, Georgia. I had no opportunity to make scale counts; but in pattern and coloration both closely resembled specimens of *P. m. melanoleucus* from New Jersey and the upper Piedmont region of South Carolina.

These are the only representatives of the genus *Pituophis* that have come to my attention during four years of collecting throughout the area under consideration. It will be observed from the above data that, in general, the pine snakes of the middle Savannah Valley resemble *P. m. melanoleucus* in markings; but show considerable tendency toward *P. m. mugitus* in their increased number of scale rows and greater sum of ventrals and subcaudals.

Specimens from the southern border of the range of *Pituophis m. melanoleucus* accordingly confirm the place of *mugitus* as a subspecies of *melanoleucus*. Further herpetological explorations in Georgia and South Carolina are obviously to be desired, and studies of this area will tend to clarify the relationships of the Floridan fauna.—WILFRED T. NEILL, *University of Georgia, Athens, Georgia.*

HIBERNATION RECORD FOR THE RED RACER.—On February 8, 1940, a red racer (*Coluber flagellum frenatum* Stejneger), was found 10 miles northwest of Palmdale, California, at an elevation of approximately 2500 feet. The snake was in a torpid condition, hibernating under the roots of a dead stump of *Yucca brevifolia*, the Joshua tree, at a depth of between 12 and 18 inches. It was coiled in a resting position. The day was cold and windy although the sun was shining. On being exposed to the direct rays of the sun, the snake became capable of locomotion.—KENNETH KINNEY, *Los Angeles, California.*

Reviews and Comments

VARIATIONS AND RELATIONSHIPS IN THE SNAKES OF THE GENUS *PITUOPHIS*. By Olive Griffith Stull. Bull. 175, U. S. National Museum, 1940: VI 225, figs. 1–84.—The doctoral thesis which comprises the basis of the work under review was completed as long ago as 1929. It now appears, no doubt substantially as originally written, there being no changes in the species and subspecies which were recognized in the summary published by Miss Stull in 1932 (Occ. Papers Mus. Zool., Univ. Mich., 250).

The genus is first surveyed at some length, the overall variations in each character being set forth. Sexual dimorphism in ventrals, caudals, and tail length is illustrated by examples. A particularly complete discussion of scale rows and the order of row suppression is given. The extent of variation in other characters is touched on. This is followed by a tabular synopsis of the 13 forms (6 species) recognized, together with a key.

Each species or subspecies is discussed in full under the following topics: synonymy, original description, systematic notes, diagnosis, description, variation, range, habits and habitat, and affinities. The inclusion of the original description is a convenience to the reader seldom permitted under the limitations of publishing today. The descriptions are accompanied by excellent pen and ink sketches showing dorsal patterns at mid-body, and, in some cases, of anterior and posterior sections where longitudinal differences are considerable. The geographical variations in scale counts, tail-length ratio, and blotches, within each subspecies, are presented in the form of charts. Complete lists of localities of the specimens examined and also of published records are given. Full tables of scale and blotch counts, and measurements are set forth; these comprise particularly useful data for those proposing to carry on further investigations in the genus, or wishing to check the author's results. About 1200 such counts are thus made available. Notes on habits and habitats are quoted from the literature. The author's conclusions with respect to phylogeny are presented in the form of diagrams of each group, as well as a discussion under each subspecies. Three cross-hatched maps summarize the ranges of all species by groups, *sayi*, the central form, being repeated on each map, an extremely satisfactory scheme from the standpoint of clarity. The work closes with general conclusions and a complete phylogenetic tree, an extensive bibliography, and a technical- and common-name index.

This monograph, representing, as it does, a thorough investigation of an economically important genus of snakes, suffers somewhat from the long delay incident to its publication, for some very extensive collections have been made during the last ten years and no doubt specimens from critical areas are now available which were sorely needed when the studies were in progress. These might have led to a modification of some of the conclusions. The synonymies have been brought down to 1936, at least in part; the bibliography contains several 1937 items, and there are evidences of a few even more recent changes in the text. But, if we may judge from the catalogue numbers of the specimens examined, the original thesis of 1929 remains substantially unchanged, as far as species data and ranges are concerned.

The geographic-variation charts are clear and complete, and show, as such charts should, the number of specimens in each group. However, they are subject to one serious criticism; after demonstrating the importance of sexual dimorphism in many of the characters, particularly ventrals and caudals, Miss Stull has combined the sexes in the charts. As a result some of the variations which are indicated as being geographical, are really the effect of an unbalance between the sexes in the samples. With respect to the scale-row charts, it may be considered doubtful whether they show exactly what they purport, since there are really three variables on the vertical scale, and the order of precedence among them is chosen arbitrarily. It is impossible to tell the whole story in a single chart where anterior and posterior scale rows, as well as those at mid-body, are to be indicated.

These geographical-variation charts are based on means and extremes, and the latter

assign too much importance to single specimens; in fact, there is here an obvious tendency to emphasize the unusual—the freak or aberrant. An improvement would be secured in charts of this type by thickening the vertical line in the center to indicate the standard error of the mean, or some multiple, such as twice or three times the standard error. Then it would be possible to pick out significant differences almost at a glance, and there would be less tendency to assign too much weight to small samples. An indication of the interquartile range is also of value in such charts.

The only other revision of the gopher snakes appearing within the past 25 years or so, was that of Van Denburgh and Slevin,[1] which was restricted to the western forms. The principal differences between their findings and those of Miss Stull are:

Area	V. and S.	Miss Stull
Arizona	*P. c. rutilus*	*P. s. affinis*
Utah, Idaho	*P. c. stejnegeri*	*P. c. deserticola*
Klamath, Sacramento Valleys	*P. c. heermanni*	*P. c. catenifer*

Since the appearance of Miss Stull's summary in 1932, most check lists and faunal lists have followed her in the non-recognition of *rutilus, stejnegeri,* and *heermanni.*

The choice of name for the Arizona gopher snake is more a matter of nomenclature than classification, although the relationship between the species *catenifer* and *sayi* is obviously involved. Miss Stull gives as her reason for not recognizing *stejnegeri* and *heermanni* the width of the character overlaps. Yet the differences pointed out by Van Denburgh and Slevin do exist and are significant; the question of their recognition depends on one's feeling toward the whole problem of subspecies. For example, I have checked the Van Denburgh and Slevin criterion of scale rows plus preoculars being over or under 33, in 60 specimens from Utah, and 72 from the Mohave and Colorado deserts in California, and find the coefficient of divergence to be 3.08 ∓ 0.76 per cent, which is both marked and significant. Using the criterion of Ginsburg,[2] to which I do not particularly subscribe, the measure of intergradation is found to be 15.6 per cent, which in his system, indicates a valid subspecies. At any rate, it is not felt that Miss Stull has said the last word on the validity of these western subspecies. Her allocations in the San Joaquin Valley are particularly disquieting, with no less than three subspecies in a single area.

It is to be regretted that Miss Stull has not been more critical in judging the authenticity of the localities of specimens purporting to be from places considerably beyond previously known ranges, for some have led to conclusions which do not appear justified. Also, specimens have been allocated strictly in accordance with a key which, from its own terminology, is not presumed to determine every specimen accurately. Known habitat preferences are sometimes ignored in delineating ranges. As a result of these methods, we have an extension and overlapping of ranges, some of which, to say the least, are highly improbable.

Nowhere is this situation better exemplified than in extreme southern California, where no less than six species and subspecies are stated to occur. There are *P. d. deppei, P. vertebralis, P. c. catenifer, P. c. annectens, P. c. deserticola,* and *P. s. affinis.* Taking these in order, we find that the range of *deppei* (a Mexican plateau form) is extended from Durango through coastal Sinaloa and Sonora, and across the Colorado Desert to coastal California, on the strength of a single specimen, AMNH 3522, taken by Miss Stull to be from "Real de Pinos, California." But the actual record entry seems to be "Real de Pinos, Gulf of California, Mexico," the confusion having arisen by reason of a rather careless use of ditto marks by the original cataloguer. The specimen is one of a lot sent in by Diguet in 1899–1901. Just where "Real de Pinos" is does not seem to be known; it may be in Sinaloa or Nayarit. At any rate, there is no real evidence to show that *deppei* invades the truly desert areas of Sonora, much less those of California. As to the two San Marcos, Texas, specimens of *deppei,* upon which Miss Stull extended the range into central Texas, Mr. Charles M. Bogert advises that these are *Elaphe obsoleta confinis.* Thus, *deppei* is not shown to occur in the United States in either California or Texas, and should be eliminated from our U. S. check lists and keys.

Coming now to *vertebralis,* we find its presence in the United States to be premised

[1] Proc. Cal. Acad. Sci., Ser. 4, 9, 1919:197; 10, 1920:1.
[2] Zoologica, 23, 1938:253.

on two specimens, one from Jim Grey, San Bernardino County, California, and the other from Fort Reading. Miss Stull was unable to determine the location of Fort Reading; actually it is an early name for Fort Redding, which was located near the present town of Redding in Shasta County, California. This is far distant from the possible range of *vertebralis*, although some of the gopher snakes of the upper Sacramento Valley are brightly colored like this species. But more important is the specimen from Jim Grey, which is in my own collection; on the strength of this single individual Miss Stull has made a northern range extension of *vertebralis* of some 400 miles, from Lat. 30° in Lower California to Lat. 35° in the Mohave Desert of California. Examination shows that this specimen does not differ in any important particular from others of a large series of *deserticola* collected within from 5 to 10 miles of Jim Grey. It is true that the blotches are dark at the head and tail, and light at mid-body, but this is characteristic of specimens of *deserticola* in many parts of the western Mohave; indeed, there are some with all blotches dark, others all light, and there are all grades between. The same may be said of the size of the blotches; the key is not infallible in this character. Excluding this Jim Grey specimen, the northern known limit of *vertebralis* is found to be El Marmol (Onyx Mine) in Lower California. This species therefore should be eliminated from the fauna of California and the United States.

I may say in passing that *vertebralis* is the only species of *Pituophis* now known to occur in Lower California south of El Marmol. Miss Stull maps the range of *annectens* (Fig. 63) as extending beyond El Marmol, southeasterly some 550 miles to the Cape; but a study of her Table 14 shows that this extension is based on 3 MVZ specimens from San José. Miss Stull has interpreted this locality as San José del Cabo, whereas these snakes were collected at the San José (there are some 7 in Lower California) at Lat. 31°, as stated by Linsdale (U. C. Pubs., in Zool., 38 (6), 1932: 377). Actually the range of *annectens* seems to terminate at the south end of the Sierra San Pedro Mártir, and near Rosario on the west coast. There appears to be no evidence of intergradation between *annectens* and *vertebralis*, although their ranges may approach within a few miles of each other and might overlap. However, intergradation between *vertebralis* and *deserticola* along the Gulf of California coast is by no means impossible; no specimens are yet available from this almost inaccessible region. Such intergradation is suggested by the close resemblance of the two forms.

Returning again to the situation in San Diego County, we find Miss Stull extending the subspecies *catenifer catenifer* into that area, notwithstanding its being the type locality of *catenifer annectens*. This overlap is premised on the allocation of three specimens from San Diego County to *catenifer*, while the other 77 specimens which she examined from the county were assigned to *annectens*. In view of the fact that the subspecies *annectens* and *catenifer* are differentiated on the number of dorsal spots, the ventrals plus caudals, and relative tail lengths, in all of which characters there is considerable individual variation and also sexual dimorphism, it would have been better not to have allocated specimens as if the key were infallible, but rather to have used a combination of the key and the locality. Average differences fully validate subspecies when there are enough specimens to demonstrate significance; it should not be expected that every specimen will key correctly—if it did there would be no intergrades and the relationship would not be subspecific. So instead of showing a range overlap between *annectens* and *catenifer*, all the way from Pit River and Monterey County in northern and central California, to San Diego on the south, I think it would have been better to have assigned by geography the few which failed to key out properly. Also, a determination of the locality (probably Santa Barbara County), where the forms were equally divided by the application of the key (say from about 40–60 to 60–40 per cent), would have fixed the area of intergradation. This Miss Stull has not determined.

Lastly, there is the relationship of *affinis* and *deserticola*. Miss Stull concludes that they are separate species, overlapping in the lower basin of the Colorado River in southeastern California and northeastern Lower California. But her conclusions are based on 6 *affinis* and 3 *deserticola* from this area; and of the former, one (USNM 1546), is really from northeastern Sonora, and the localities of two others are doubtful. With some 85 specimens now available from this area, I do not find the presence of two species readily apparent; nor indeed is there evident any superficial difference from those found across the Colorado River in the Yuma region, so that any segregation is

more likely to be subspecific—a matter of averages—rather than specific. But these are points which require further investigation before a conclusion is warranted. Incidentally, this relationship between *deserticola* and *affinis* will determine whether *sayi* will be retained as a specific name, or whether the prairie forms will be known as *P. catenifer affinis* and *P. c. sayi*.

In any case it has been indicated that the six forms allocated by Miss Stull to extreme southern California can be reduced to three at most, and probably to only two, the coastal *annectens* and transmontane *deserticola*. I would summarize by stating that I do not think Miss Stull's range data should be accepted without question; in fact, each species overlap (as differentiated from a mere area of intergradation between subspecies, which may be wide or narrow, depending on the methods of the classifier), should receive careful scrutiny.

In her phylogenetic discussion Miss Stull concludes that the genus arose in or near the range of *affinis* and that this is the ancestral form. An extension of her reasoning beyond *Pituophis* might transfer this conclusion to *deppei* or even *lineaticollis*, since these forms are closer to a generalized ancestral colubrid; and, therefore, if descended from *affinis*, must have reversed the tendencies toward specialization (i.e., the multiple prefrontals and peculiar rostral) elsewhere present in the genus.—L. M. KLAUBER, *San Diego, California.*

CHINA'S ANIMAL FRONTIER. By Clifford H. Pope. The Viking Press, New York, 1940: 1–192, illus. $2.50.—Perhaps only a minority of the readers of Mr. Pope's admirable popular books on the North American snakes and turtles will have seen his monumental work on Chinese reptiles, on which his reputation among his technical colleagues largely rests. Both his larger amateur audience and the more professional herpetologists will welcome his new book for the insight it gives into his travels and into the background out of which his books have grown. The book proves to be interesting in its own right, whether one has known Mr. Pope through his books, or personally, or never heard of him, for its pages reflect a picture of a sympathetic and more than usually competent traveler. One might almost say that Mr. Pope was born to travel in China, for while college German was difficult for him (as he tells us) he had no trouble in learning Chinese.

With Chinese at his command, Mr. Pope's work of collecting fishes, amphibians, reptiles, and mammals for the Asiatic expeditions of the American Museum of Natural History carried him from northernmost China and Inner Mongolia to the southernmost Chinese territory of the island of Hainan. Herpetologists will be especially interested in his account of his trip to collect the Chinese alligator; of his ever successful bargaining with the Chinese villagers for specimens; and of his collecting of frogs and tadpoles from the mountain streams of Fukien.

The reviewer feels that Mr. Pope's book gives a singularly true picture of the activities and interests of a modern museum collector in the field.—KARL P. SCHMIDT, *Field Museum of Natural History, Chicago, Illinois.*

THE FISHES OF THE INDO-AUSTRALIAN ARCHIPELAGO VIII PERCOMORPHI (continued) CIRRHITOIDEA, LABRIFORMES, POMACENTRIFORMES. By L. F. de Beaufort. E. J. Brill, Leiden, 1940: i–xv, 1–508, frontispiece and figs. 1–56.—One of the few sources of gratification emerging from hell-bent Europe is the receipt from time to time of scientific publications untinged by war. The continuation of such fundamental treatises as "The Fishes of the Indo-Australian Archipelago" is particularly welcome. As I wrote in reviewing Volume VI, "It is with much satisfaction that ichthyologists everywhere watch the continued production of this monumental work, which will long remain indispensable in any serious research on the systematics of Indo-Pacific fishes: the great mother fish fauna of the world."

In a touching memorial, and with a splendid frontispiece portrait, de Beaufort dedicates this book to Max Weber, the senior author of the seven previous volumes. It is understood that F. P. Koumans of the Leiden Museum has completed the manuscript for Volume IX, which will be devoted to the multitudinous gobioid fishes of the East Indies. We trust that the grand project will not remain unfinished, as was Bleeker's *Atlas Ichthyologique des Indes Orientales Néèerlandaises.*—CARL L. HUBBS, *University of Michigan Museum of Zoology, Ann Arbor, Michigan.*

THE NEW SYSTEMATICS. Edited by Julian Huxley. Oxford University Press, London and New York, 1940. viii + 583 pp.—Slowly turns the worm, but surely. Out of the theories and bickerings and blind alleys of Darwinism, the neo-Lamarckians, Weismann, Bateson, the neo-Darwinians, and all the rest of biology, is finally emerging a yet shadowy but unmistakable picture of what evolution really is. No one theory has held the field undamaged; each has contributed to the advance, albeit usually in a manner unforeseen by its proponents. The prime fact of natural selection still stands, but it waited long for the geneticists to point the way to the *origin* of the fittest. And by a strange trick of fate the neo-Lamarckians have in a sense been justified, through (of all things) Weismannism, by the discovery that the germ-plasm can be affected by the environment, though not in a directive way.

Through all this welter the plodding systematist has held doggedly to his belief that only the taxonomist could really understand how species evolve—and he, too, has been justified, even if in ways strange to him. It is a notable phenomenon that those experimentalists who have recently done most to put the evolutionary house in some sort of order have been, undeniably, systematists, working with the viewpoint of systematists on purely systematic problems. But both the old-fashioned specimen systematist and the old line experimental biologist have had at last to realize that the organisms with which the evolutionist must work are neither a cage full of laboratory animals nor a row of dead specimens in a museum, but instead the natural populations of living things in the field. With this point of view once understood, the great truth that the study of evolution is synonymous with systematics becomes still more clearly evident.

The New Systematics emphasizes this truth. The book is a direct result of the organization in England of the "Association for the Study of Systematics in Relation to General Biology," a society similar in scope to several older but more local and less formalized groups in this country. The volume consists of twenty-one chapters on different phases of systematics by eminent specialists in systematics, genetics, ecology, statistics, paleontology, morphology and physiology, introduced by a general chapter by the editor. Among the authors are N. Timofeeff-Ressovsky, C. D. Darlington, Sewall Wright, H. J. Muller, Lancelot Hogben, E. B. Worthington, G. R. de Beer, J. A. Moy-Thomas, W. T. Calman and N. I. Vavilov. The various chapters deal, among other things, with mutations and geographical variation; taxonomic species and genetic systems; the bearing of recent *Drosophila* genetics on speciation; geographical differentiation in fresh waters; the problem of closely related species living in the same area; ecology and the future of systematics; the relations of taxonomy to embryology, paleontology and philosophy; natural hybridization; and the museum zoologist's view of taxonomy.

Any critical review of the different contributions is impossible in the short space of a review. Indeed, one or more of the chapters is liable to prove stiff reading for any biologist, whatever his line. In a symposium of this type, unevenness of treatment is inevitable, and a few of the papers do not greatly impress the reviewer. Moreover, it is quite evident that there are divergencies among the authors in their understanding of the problem. There is even a hint that some of them have not yet clearly recognized the prime fact that taxonomy and nomenclature are utterly distinct things, and that type specimens are something more than nomenclatural hitching-posts. But the average of the different chapters is high, and the systematist as well as the general biologist who fails to become acquainted with this book must indeed be called a narrow specialist.

To readers of COPEIA, the chapter of most immediate special interest will be Worthington's "Geographical differentiation in fresh waters with especial reference to fish." Based largely on the author's own wide acquaintance with British and East African fishes, it is an able and well documented exposition of the subject, particularly in relation to the intensely interesting and instructive fish faunas of the African lakes. His conclusions in relation to the concomitant evolution of environments and species, the powerful effect of predators in preventing excessive speciation, the differences in adaptive ability of various groups of fishes, and the probability of faster evolutionary divergence in tropical than in temperate poikilothermous animals, are all of importance. The reviewer's one adverse comment concerns Worthington's unquestioning acceptance of D. H. Thompson's "distance cline" in the fin-ray counts of *Boleosoma*.—GEORGE S. MYERS, *Stanford University, California.*

ADVANCES AND APPLICATIONS OF MATHEMATICAL BIOLOGY. By Nicolas Rashevsky. University of Chicago Press, 1940: 214 pp., 58 figs. $2.00.—Another book by Rashevsky serves to remind the biologist that mathematics is part of the training necessitated by modern science. In the present volume Rashevsky applies the principles developed in his previous work to certain problems of cellular physiology; notably diffusion, cell respiration, cell growth, cell form and movements.

Those not acquainted with the field covered by the *Bulletin of Mathematical Biophysics* may be misled by the title and turn to this volume expecting a treatment of statistics, a form of mathematics more familiar to the average reader of COPEIA than the mathematical formulation of the physical laws involved in cell activity.—F. W. WEYMOUTH, *Stanford University, California.*

PROBLEMS OF LAKE BIOLOGY. By Forest Ray Moulton, Editor. Publication of the American Association for the Advancement of Science No. 10, The Science Press, 1939: 9–142, 1 table, 3 figs. $2.00.—*Problems of Lake Biology* is a group of nine papers originally presented as a symposium at a meeting of the Limnological Society of America, in December, 1938. In order of appearance, the papers cover the following subjects: physics and chemistry, solar energy, bacteria, phytoplankton, zooplankton, microscopic fauna of sandy beaches, rooted plants, bottom fauna, and fish. The general plan of presentation is similar in each: a review of the facts and theories, with suggestions for investigations in the future.

A symposium in a young and growing science is always of interest, and the present one is particularly timely because of the significant advances made in the past decade. *Problems of Lake Biology* will be especially convenient for the general biologist who desires a broad view of lake biology without the necessity of reading a long book. The editor suggests, in the introduction, that it should establish a firm foundation for future work, but that is too much to expect of a volume of 142 pages in a science as complex as the one under consideration.

There is some confusion in the use of terms, and the reader may be left in doubt as to the relationship of lake biology to limnology. On the whole, the confusions seem not to be excessive, considering the possibilities in a volume of this kind. Editorial supervision of the placing of commas would have been a great help to the reader.

It is unfortunate that the symposium did not include a paper by a geologist. A number of the authors discussed lake problems from a geological point of view, but the whole subject has been so neglected, and is so intimately concerned with other problems, that it merits special attention.

Pennak's paper on the microscopic fauna of sandy beaches is of special interest because of the newness of the subject. Extension of our knowledge of similar situations in other parts of the world is particularly needed.

Less can be said with certainty of the bacteria than of other large groups of aquatic organisms. Many biologists will be surprised to learn that almost nothing is known of the taxonomy of bacteria characteristic of water, and not much more of their distribution and functions. If Henrici's review leads other bacteriologists to an active interest in the problems which await them in natural waters, it will have performed a useful service.

The limitations of space do not permit the mention of a host of interesting features in the other papers.

Early North American limnologists were preoccupied in the collection of data, and the frequent excursions of their European colleagues into the realm of theory were largely ignored. In the past few years, North American writers, particularly the younger ones, have given more and more attention to theoretical considerations, and now a number of concepts developed in Europe have wide acceptance here. Generalization is conspicuous in *Problems of Lake Biology,* a fact which is doubtless explained in part by the youth of the contributors, all of whom have done their principal researches since 1930. Possibly the symposium is significant not so much by reason of the facts and theories reviewed, nor of the suggestions for fruitful research, as by the fact that it directs attention to an important step in the coming of age of limnology on this continent.—STILLMAN WRIGHT, *U. S. Department of the Interior, Fish and Wildlife Service, Logan, Utah.*

EDITORIAL NOTES AND NEWS

Meetings

THE twenty-fourth annual meeting of the SOCIETY will be held at the University of Florida, in Gainesville, from Thursday, April 3, to Saturday, April 5, 1941. All sessions will be held in the Chemistry Auditorium, University of Florida. Visits to nearby points of interest, including Silver Springs, Marineland, the Welatka Conservation Reserve, and the Ocala National Forest, or Big Scrub, have been planned. The annual dinner will be given at the White House, Gainesville, on Thursday, April 3, and an outdoor supper is planned for the evening of April 4. The Board of Governors will meet Wednesday evening.

The White House, located at East Main St., North, Gainesville, will be the Society headquarters. Accommodations in other hotels and in private homes are also available. Those desiring to make reservations in advance may do so by writing to the White House, or to COLEMAN J. GOIN, Secretary of the Local Committee.

The Western Division of the Society will meet at the California Institute of Technology June 18 to 20, in conjunction with the Pacific Division of the American Association for the Advancement of Science. Three symposia are planned, as follows: June 18, Rattlesnakes and Other Pit Vipers; June 19, morning, Introduced Fishes on the Pacific Coast; afternoon, Africa, Zoologically Speaking. Members desiring to submit papers must send title, time required for delivery (not over 15 minutes), a 200-word abstract (2 copies), and full details of equipment needed to the Secretary of the Western Division, Margaret Storey, Box 1606, Stanford University, California. The deadline is April 15, and titles submitted after that date cannot be considered.

The Seventh Pacific Science Congress will be held in Manila, P.I., in November, 1943, provided world conditions permit. Sessions are planned on the subjects of Geological Distribution; Adaptability of Temperate Zone Animals to the Tropical Habitat; Marine Biology, and Fisheries.

News Items

ON January 1, KARL P. SCHMIDT was appointed Chief Curator of the Department of Zoology of the Field Museum of Natural History, to succeed DR. W. H. OSGOOD, who retired on December 31. Dr. Osgood remains on the museum staff as Chief Curator Emeritus.

DR. THOMAS BARBOUR has been elected, by the Board of Directors of the National Academy of Sciences, executive officer of the Canal Zone Biological Area recently established by an act of Congress. Dr. Barbour has been in active charge of the Barro Colorado Island Laboratory since its establishment.

The DEPARTMENT OF RESEARCH OF THE FISH COMMISSION of Oregon has established a fisheries laboratory at Astoria, Oregon, in the building occupied by the Food Industries Laboratory, operated by the Oregon State College. Plans for a four-year survey of waters in all representative parts of the State of Oregon and for the use of the Clackamas River as an experimental and demonstration area for fishery management practices have been completed by the FISH AND WILDLIFE SERVICE and the OREGON GAME COMMISSION. REED S. NIELSON, of the Division of Fishery Biology, represented the Service at recent conferences with Oregon officials. Mr. Nielson was recently appointed regional biologist for Forest Region No. 6. LAWRENCE D. TOWNSEND is cooperating in an investigation to determine what modification of the fisheries of the Wilamette River may take place as the result of some large flood-control dams that are planned in that watershed. His headquarters are: Room 1, McClure Hall, University of Oregon, Eugene.

DR. JOSEPH BAILEY, who sailed for Brazil in early October, is spending the year in study at the various scientific institutions of that country, under an exchange fellowship, sponsored by the Department of State.

DR. WILLIAM BEEBE has announced that part of the large collection of marine fishes which he obtained on the Pacific Coast of Central America during the 1938 expedition of Mr. Templeton Crocker's Yacht "Zaca" is eventually to be turned over to The Natural History Museum, Stanford University, for use in a projected monograph of the fishes of the eastern Pacific.

DR. WILLIS KING, who has been serving as Assistant Wildlife Technician in the Great Smoky Mts. National Park, has been appointed to a position with the North Carolina Division of Game and Inland Fisheries. He will be stationed at Raleigh and will have supervision of the fisheries program for the state.

Collections of Mexican amphibians and reptiles made by DR. and MRS. HOBART M. SMITH during Dr. Smith's tenure of a Walter Rathbone Bacon Scholarship of the Smithsonian Institution are being studied by him at the U. S. National Museum under an extension of the scholarship.

THE HONG KONG FISHERIES RESEARCH STATION was established in July, 1940, chiefly through the efforts of Dr. G. A. C. Herklots. The personnel of the station is composed as follows: Director, DR. G. A. C. HERKLOTS; Marine Biologist (Zoology), DR. SHAO-WEN LING; Superintendent of Fisheries Research, MR. S. Y. LIN; Chemist, MR. YUNG HEI-KWANG; Artist, MR. TANG YING-WEI.

DR. J. J. TER PELKWIJK of Leiden Museum recently made a tour of marine biological stations and fisheries laboratories in the United States. Dr. Pelkwijk will be stationed at the Institute Zeevisschery, Batavia, where he will make a study of the commercially important marine fishes of the Dutch East Indies.

PORFIRIO MANACOP of the Division of Fisheries, Department of Agriculture and Commerce of the Philippines, is spending several months in California, with headquarters at Stanford University. ANTOLIN AGCO, also from the Division of Fisheries in the Philippines, is visiting at the Scripps Institution of Oceanography at La Jolla to study oceanography.

GORDON GUNTER, of the Department of Zoology of the University of Texas, has been appointed Marine Biologist for the Coastal Division of the Texas Game, Fish and Oyster Commission.

Requests

DR. FERNANDO DE BUEN, formerly Chief of the Department of Biology of the Spanish Institute of Oceanography, and well known for his excellent critical researches, now has an appointment as Professor of Biology in the University of Michoacán and is directing the work of the new Limnological Laboratory on Lake Pátzcuaro. A letter of June 30, addressed to Dr. Carl Hubbs, reads:

> In the year 1936 I deserted the books to take up arms and to fight for almost three years on the different battlefields of Spain. I passed on to France working for a spell in the laboratory of Banyuls-sur-mer, and finally I came to Mexico to take charge of the Professorship in Advanced Biology, Botany and Zoology, at the University of Michoacán in the city of Morelia.
>
> As you suppose, I could save nothing of my magnificent personal library and of my laboratories in Spain. All was left there and perhaps much may be lost through the disastrous action of the war. I will very much appreciate any published works that you may be able to send me.

Dr. de Buen is at present restricting his investigations to the fishes of central Mexico but later intends to extend his studies to cover the other fresh waters of that country. He has just published an article "Pascado blanco, chacuami y charari del Lago de Pátzcuaro" (Trabajos Num. 1, Estación Limnologica de Pátzcuaro).

The Chinese ichthyologist, S. Y. LIU, who was forced to leave his position with the Chekiang Provincial Fisheries Experiment Station at the outbreak of the Sino-Japanese war, is now connected with the Hong Kong Fisheries Research Station, The University, Hong Kong, and desires to resume the exchange of publications with American ichthyologists.

Correction IN COPEIA, 4, 1940, page 256, line 18, read Species for Subspecies.

COPEIA IS THE JOURNAL OF THE AMERICAN SOCIETY OF ICHTHYOLOGISTS AND HERPETOLOGISTS

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